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# Technical Specifications for:

**Project A: Cargo Hydraulic Elevator Modernization**
at PRIDCO Headquarters, San Juan PR

I hereby certify that these specifications consist of **395** pages.

**E. Morell-Rivera Architects & Consultants PSC**

# INDEX TECHNICAL SPECIFICATIONS


| | CONTENTS | NO. OF PAGES |
|---|---|---|
| **DIVISION 1** | **GENERAL REQUIREMENTS** | |
| 01014 | Contractor use of Premises | 1 |
| 01029 | Change Order Procedure | 1 |
| 01040 | Project Coordination | 1 |
| 01045 | Cutting and Patching | 3 |
| 01050 | Field Engineering | 2 |
| 01060 | Correction Of Work | 1 |
| 01085 | Applicable Standards | 3 |
| 01200 | Project Meeting | 2 |
| 01300 | Submittals and Substitutions | 5 |
| 01310 | Construction Schedule | 7 |
| 013545 | Environmental Protection During Construction | 2 |
| 01380 | Construction Photographs | 2 |
| 01400 | Quality Control | 2 |
| 01410 | Testing Laboratory Services | 3 |
| 01500 | Temporary Facilities and Controls | 3 |
| 01505 | Mobilization | 2 |
| 015600 | Temporary Barriers and Security During Construction | 2 |
| 01560 | Environmental Controls | 3 |
| 01590 | Field Office and Sheds | 4 |
| 01700 | Contractor Closeout | 3 |
| 01710 | Cleaning | 3 |
| 01720 | Project Record Documents | 4 |
| | | **54** |
| **DIVISION 2** | **SITE WORK** | |
| 02070 | Selective Demolition | **4** |
| **DIVISION 3** | **CONCRETE** | |
| 03542 | Hydraulic-Cement-Based Underlayment | 5 |
| 03600 | Grouts | 2 |
| 03900 | Concrete Restoration and Cleaning | 7 |
| 03930 | Concrete Rehabilitation | 19 |
| | | **33** |

| | | |
|---|---|---|
| **DIVISION 4** | **MASONRY** | |
| **DIVISION 5** | **METALS** | |
| 05120 | Structural Steel | 13 |
| 05500 | Metal Fabrications | 21 |
| 05530 | Gratings | 17 |
| | | **51** |
| **DIVISION 6** | **CARPENTRY** | |
| **DIVISION 7** | **THERMAL AND MOISTURE PROTECTION** | |
| 07620 | Sheet Metal Flashing and Trim | 24 |
| 078413 | Penetration Fire stopping | 11 |
| 07920 | Joint Sealants | 13 |
| | | **48** |
| **DIVISION 8** | **DOORS AND WINDOWS** | |
| 08111 | Steel Doors and Frames | 13 |
| 08711 | Door Hardware | 55 |
| 08900 | Fixed Louvers | 10 |
| | | **78** |
| **DIVISION 9** | **FINISHES** | |
| 09180 | Cement Plaster | 05 |
| 096723 | Resinous Epoxy Flooring | 08 |
| 09900 | Painting | 09 |
| 09912 | Interior Painting | 24 |
| | | **46** |
| **DIVISION 10** | **SPECIALTIES** | |
| **DIVISION 11** | **EQUIPMENT** | |
| **DIVISION 12** | **FURNISHINGS** | |
| **DIVISION 13** | **SPECIAL CONSTRUCTION** | |
| **DIVISION 14** | **CONVEYING EQUIPMENT** | |
| 14245 | Hydraulic Freight Elevators | 12 |
| 142400 | Operating features (Freight, Security & Safety) | 03 |
| | | **15** |

| | | |
|---|---|---|
| **DIVISION 22** | **PLUMBING** | |
| 22 05 11 | Common work results for PLUMBING | 30 |
| **DIVISION 23** | **HEATING, VENTILATING & AIR CONDITIONING (HVAC)** | |
| **DIVISION 26** | **ELECTRICAL** | |
| 260511 | Electrical Works – General | 10 |
| 260519 | Electrical Wires And Cables | 5 |
| 260526 | Grounding | 5 |
| 260533.13 | Electrical Raceway System | 8 |
| 260800 | Field Acceptance Tests | 3 |
| 262726 | Wiring Devices | 5 |
| 265100 | Lighting | 3 |
| | | **39** |
| | **TOTAL:** | **395** |

# Division 1-General Requirements

**DIVISION - 1 GENERAL REQUIREMENTS**

**SECTION 01 14 00 WORK RESTRICTIONS - ACCESS TO SITE / COORDINATION WITH OCCUPANTS / USE OF SITE**

## PART 1 - GENERAL

### 1. REQUIREMENT

a. Contractor shall coordinate use of premises for construction purposes with Owner. Because of the nature of project premises, Contractor shall provide Owner with complete minimum surface area requirements for him and his personnel use, including area requirements for:

1. Storage of materials and equipment
2. Staging
3. Employee parking
4. Refuse containers
5. Other required uses

**END OF SECTION**

**DIVISION - 1 GENERAL REQUIREMENTS**

**SECTION - 01029 CHANGE ORDER PROCEDURES**

## PART 1 - GENERAL

### 1. GENERAL

a. This section specifies change order procedures, which form part of the contract and are specified herein.

### 2. WORK AUTHORIZATION

a. In the event the Owner requires a change to the work, the Owner will issue a written “Work Authorization” for changes to the contract. The authorization will include actual or estimated costs for the change and a statement of responsibility for actual cost if estimated costs are used.

### 3. CONTRACTOR RESPONSE

a. Contractor shall respond with a formal typewritten "Contract Change Order", in triplicate, referencing authorization number, job name, date, specific items changed and shall indicate total amount of authorization imposed costs. **Backup documentation is to be submitted with all extra costs**. Two or more authorizations may be included on one change order.

**END OF SECTION**

**DIVISION - 1 GENERAL REQUIREMENTS**

**SECTION - 01040 PROJECT COORDINATION**

## PART 1 - GENERAL

### 1. PROJECT COORDINATION

a. Contractor shall be responsible for the general overall coordination of the work required. It is the Contractor's responsibility to see that all of his subcontractors coordinate their work as it relates to the work of other trades.

### 2. MECHANICAL AND ELECTRICAL COORDINATION

a. Contractor shall coordinate the leaving of openings in the building floors, roofs and walls for supply, return and exhaust ducts, piping and wiring unless otherwise noted or specified herein. It is the Contractor's responsibility to see that all of his subcontractors coordinate their work with regard to openings, which are to be left in floors, roof and partitions for the proper operation of all systems, and that all openings are in correct locations.

### 3. CUTTING AND PATCHING

a. Except as otherwise specified, each subcontractor shall execute all cutting and patching in his work that may be required by others so that the engagements between the various material will be neat and proper. Cutting of any structural portions of the building shall not be permitted except as approved by the Owner. Each subcontractor shall locate and provide sleeves, suitable to the general contractor, for all holes, chases, openings, or block-outs required for the installation of their work. All such openings shall be straight, true, and of proper size. Excessive cutting will not be permitted, nor shall openings be located to alter the installation of any structural member from that indicated on drawings. After the work has been installed, all openings shall be carefully patched and fitted around as directed and to the satisfaction of the Owner.

**END OF SECTION**

# SECTION 01045
# CUTTING AND PATCHING

## PART I GENERAL

### 1.01 DEFINITION

A. "Cutting-and-patching" is hereby defined to include, but is not necessarily limited to, the cutting and patching of nominally completed and previously existing work, in order to accommodate the coordination of work, or the installation of other work, or the uncover other work for access or inspection, or to obtain samples for testing, or for similar purposes; and is defined to excluded integral cutting-and-patching during the manufacturing, fabricating, erecting and installing process for individual units of works.

### 1.02 RELATED WORK

A. Refer to the mechanical and electrical sections, for additional requirements and limitation on the cutting-and-patching of mechanical and electrical work, respectively. The requirements of this section apply to mechanical and electrical work, unless otherwise indicated.

B. Demolition is recognized as an example of a related-but-separate category of work, which may or may not also require cutting-and-patching as defined in this section.

### 1.03 QUALITY ASSURANCE

A. Perform all cutting-and-patching in strict accordance with pertinent requirements of these Specifications and, in the event no such requirements are determined, in conformance with the Architect's written direction.

B. Do not cut-and-patch structural work in a manner resulting in a reduction of load-carrying capacity or load/deflection ration.

C. Do not cut-and-patch operational elements and safety-related components in a manner resulting in a reduction of capacities to perform in the manner intended or resulting in decreased operational life, increased maintenance, or decreased safety.

D. Do not cut-and-patch work which is exposed on the exterior or exposed in occupied spaces of the building, in a manner resulting in a reduction of visual qualities or resulting in substantial evidence of the cut-and-patch work, both as judge solely by the Architect. Remove and replace work judge by the Architect to be cut-and-patched in a visually unsatisfactory manner.

## 1.04 SUBMITTALS

A. Request for Architect's consent:

Prior to cutting which affects structural safety, submit written request to Architect for permission to proceed with cutting.

B. Proposals for Cutting-and-Patching:

1. Where prior approval of cutting-and-patching is required, submit proposal well in advance of time work will be performed, and request approval to proceed. Include description of why cutting-and-patching cannot (reasonably) be avoided, how it will be performed, how structural elements (if any) will be reinforced, products to be used, firms and tradesmen to perform the work, approximate dates of the work, and anticipated results in terms of variations from the work as originally completed (structural, operational, visual and other qualities of significance). Where applicable, include cost proposal, suggested alternatives to the cutting-and-patching procedure proposed, and a description of the circumstances which lead to the need for cutting-and-patching.

2. Approval by Architect to proceed with proposed cutting-and-patching does not waive right to later require complete removal and replacement of work found to be cut-and-patched in an unsatisfactory manner.

# PART II PRODUCTS

## 2.01 MATERIALS

A. Provide materials for cutting-and-patching which will result in equal-or-better work than the work being cut-and-patched, in terms of performance characteristics and including visual effect where applicable. Comply with the requirements, and use materials identical with the original materials where feasible and where recognized that satisfactory results can be produced thereby.

B. For replacement of work removed, use materials which comply with the pertinent Sections of these Specifications.

## 2.02 PAYMENT FOR COSTS

A. Perform all cutting-and-patching needed to comply with the Contract Documents at no additional cost to the owner.

## PART III EXECUTION

### 3.01 INSPECTION

A. Inspect existing conditions, including elements subject to movement or damage during cutting, excavating, backfilling, and patching. After uncovering the work, inspect conditions affecting installation of new work. If uncovered conditions are not as anticipated, immediately notify the Architects and secure needed directions. Do not proceed in areas of discrepancies until all such discrepancies have been fully resolved.

### 3.02 PREPARATION

A. Temporary Support:

Provide adequate temporary support for work to be cut, to prevent failure. Do not endanger other work.

B. Protection:

Provide adequate protection of other work during cutting-and-patching, to prevent damage; and provide protection of the work from adverse weather exposure.

### 3.03 PERFORMANCE

A. Perform all required excavating and backfilling as required under pertinent Sections of these Specifications. Perform cutting and demolition by methods which will prevent damage to other portions of the work and will provide proper surfaces to received installation of repair and new work. Perform fitting and adjustment of products to provide finished installation complying with the specified tolerances and finishes.

B. Employ skilled tradesmen to perform cutting-and-patching. Cut work with saving and grinding tools, not with hammering and chopping tools.

C. Restore exposed finishes of patched areas; and, where necessary extend finish restoration onto retained work adjoining, in a manner which will eliminate evidence of patching.

**END OF SECTION**

**SECTION 01085**
**APPLICABLE STANDARDS**

## PART I GENERAL

### 1.1 DESCRIPTION

1.1.1 Work included:

1.1.1.1 Throughout the Contract Documents, reference is made to codes and standards which establish qualities and types of workmanship and materials, and which establish methods for testing and reporting on the pertinent characteristics.

1.1.1.2 Where materials or workmanship are required by these Contract Documents to meet or exceed the specifically named code or standard, it is the Contractor's responsibility to provide materials and workmanship which meet or exceed the specifically named code or standard.

1.1.1.3 It is also the Contractors' responsibility, when so required by the Contract Documents or by written request from the Architects, to deliver to the Architect all required proof that the materials or workmanship, or both, meet or exceed the requirements of the specifically named code or standard. Such proof shall be in the form requested in writing by the Architect, and generally will be required to be copies of a certified report of tests conducted by a testing agency approved for that purpose by the Architect.

1.1.2 Related work described elsewhere: Specific naming of codes or standards occurs on the Drawings and in other Sections of these Specifications.

### 1.2 QUALITY ASSURANCE

1.2.1 Familiarity with pertinent codes and standards: In procuring all forms used in this Work, it is the Contractor's, responsibility to verify the detailed requirements of the specifically named codes and standards and to verify that the items procured for use in this Work meet or exceed the specified requirements.

1.2.2 Rejection of non-complying items: The Architect reserves the right to reject items incorporated into the Work which fail to meet the specified minimum requirements. The Architect further reserves the right, and without prejudice to other recourse the Architect may take, to accept non-complying items subject to an adjustment in the Contract Amount as approved by the Architect and the Owner.

1.2.3 Applicable standards listed in these Specifications include, but are not necessarily limited to, standards promulgated by the following agencies or organizations:

(1) AASHTO = American Association of State Highway and Transportation Officials, 341 National Press Building, Washington, D. C. 20004.

(2) ACI = American Concrete Institute, Box 19150, Redford Station, Detroit, Michigan 48219.

(3) AISC = American Institute of Steel Construction, Inc., 1221 Avenue of the Americas, New York, New York 10020.

(4) ANSI = American National Standards Institute (successor to USASU and ASA) 1430 Broadway, New York, New York 10018.

(5) ASTM = American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.

(6) AWS = American Welding Society, Inc., 2501 N.W. 7th Street, Miami, Florida 33125.

(7) AWWA = American Water Works Association, Inc., 6666 West Quincy Avenue, Denver Colorado 80235.

(8) CRSI = Concrete Reinforcing Steel Institute, 228 North LaSalle Street, Chicago, Illinois 60610.

(9) CS = Commercial Standard of NBS, U.S, Department of Commerce, Government Printing Office, Washington, D.C. 20402.

(10) FGMA = Flat Glass Marketing Association, 3310 Harrison, Topeka, Kansas 66611.

(11) NAAMM = The National Association of Architectural Metal Manufacturers, 1033 south Boulevard, Oak Park, Illinois 60302.

(12) NEC = National Electrical Code (see NFPA).

(13) NEMA = National Electrical Manufacturers Association, 155 East 44th Street, New York, New York 10017.

(14) NFPA = National Fire Protection Association, 470 Atlantic Avenue, Boston, Massachusetts 02210.

(15) SDI = Steel Deck Institute, 135 Addison Avenue, Elmhurst, Illinois 60125.

(16) SSPC = Steel Structures Painting Council, 4400 5th Avenue, Pittsburgh, Pennsylvania 15213.

(17) TCA = Tile Council of America, Inc., P.O. Box 326, Princeton, New Jersey 08540.

(18) UL = Underwriter's Laboratories, Inc., 207 East Ohio Street, Chicago, Illinois 60611.

(19) Fed Specs and Fed Standards

Specifications Sales (3FRI), Bldg, 197, Washington Navy Yard, General Services Administration, Washington, D. C. 20407.

(20) MIL-SPECS

Military Specifications, Superintendent of Documents, U.S. Government Printing Office, Washington D.C. 20402.

(21) UBC = Uniform Building Code, International Conference of Building Officials, 5360 South Workman Mill Road, Whittier, California 90601.

**END OF SECTION**

# SECTION 01200
# PROJECT MEETINGS

## PART I GENERAL

### 1.1 DESCRIPTION

1.1.1 Work included: To enable orderly review during progress of the Work, and to provide for systematic discussion of problems, the Architect will conduct project meetings throughout the construction period.

1.1.2 Related work described elsewhere: The Contractor's relations with his subcontractors and materials suppliers, and discussions relative thereto, are the Contractor's responsibility and are not part of project meetings content.

### 1.2 QUALITY ASSURANCE

Persons designated by the Contractor to attend and participate in the project meetings shall have all required authority to commit the Contractor to solutions agreed upon in the project meetings.

### 1.3 SUBMITTALS

1.3.1 Agenda items: To the maximum extent practicable, advise PRPA Contract Manager at least 24, hours in advance of project meetings regarding all items to be added to the agenda.

1.3.2 Minutes: PRPA Contract Manager will compile minutes of each project meeting and will furnish a PDF file and one (1) copy to the Contractor. The Contractor may make and distribute additional copies as he wishes.

## PART II PRODUCTS

(No products are required in this Section.)

## PART III EXECUTION

### 3.1 MEETING SCHEDULE

Except as noted below for Preconstruction Meeting, project meetings will be held weekly. Coordinate as necessary to establish mutually acceptable schedule for meetings.

### 3.2 MEETING LOCATION

To the maximum extent practicable, meetings will be held at the job site.

## 3.3 PRE-CONSTRUCTION MEETING (Same day of Notice to Proceed)

3.3.1 Preconstruction meeting will be scheduled within 2 hours after the Owner has issued Notice to Proceed. Provide attendance by authorized representatives of the Contractor and all major subcontractors. The Architect will advise other interested parties and request their attendance.

3.3.2 Minimum agenda: Distribute data on, and discuss:

(1) Organizational arrangement of Contractor's forces and personnel, and those of subcontractors, materials suppliers, and Architect.

(2) Channels and procedures for communications.

(3) Construction schedule, including sequence of critical work.

(4) Contract Documents, including distribution of required copies of original Documents and revisions.

(5) Processing of Shop Drawings and other data submitted to the Architect for review.

(6) Processing of field decisions and Change Orders.

(7) Rules and regulations governing performance of the Work.

(8) Procedures for safety and first aid, security, quality control, housekeeping, and other related matters.

## 3.4 PROJECT MEETINGS

3.4.1 Attendance: To the maximum extent practicable, assign the same person or persons to represent the Contractor at project meetings throughout progress of the Work. Subcontractors, materials suppliers, and others may be invited to attend those project meetings in which their aspects of the Work are involved.

3.4.2 Minimum agenda:

(1) Review, revise as necessary, and approved minutes of previous meeting.

(2) Review progress of the Work since last meeting, including status of submittals for approval.

(3) Identify problems which impede planned progress.

(4) Develop corrective measures and procedures to regain planned schedule.

(5) Complete other current business.

**END OF SECTION**

**SECTION 01300**
**SUBMITTALS AND SUBSTITUTIONS**

## PART I GENERAL

### 1.3 SUBMITTALS

1.3.1 Submittal schedule: Within 2 hours after award of Contract, submit to the Architect two (2) copies of the schedule described in Article 2.1 of this Section. Refer to Bid Proposal, Attachment B - List of deliverables.

1.3.2 Certificates of Compliance: Upon completion of the Work, and as a condition of its acceptance, submit to the Architect all Certificates of Compliance.

1.3.3 Make all submittals of Shop Drawings, Samples, requests for substitution, and other items, in strict accordance with this Section.

## PART II PRODUCTS

### 2.1 SUBMITTAL SCHEDULE

2.1.1 General: Compile a complete and comprehensive schedule of all submittals anticipated to be made during progress of the Work. Include a list of each type of item for which Contractor's drawings, Shop Drawings, Certificates of Compliance; material samples, guarantees, or other types of submittals are required. Upon approval by the Architect this schedule will become part of the Contract and the Contractor will be required to adhere to the schedule except when specifically otherwise permitted.

2.1.2 Coordination: Coordinate the schedule with all necessary subcontractors and materials suppliers to ensure their understanding of the importance of adhering to the approved schedule and their ability to so adhere. Coordinate as required to ensure the grouping of submittals as described in Paragraph 3.2 below.

2.1.3 Revisions: Revise and update the schedule on a monthly basis as necessary to reflect conditions and sequences. Promptly submit revised schedules to the Architect for review and consent.

## 2.2 SHOP DRAWINGS AND COORDINATION DRAWINGS

2.2.1 Shop Drawings:

2.2.1.1 Scale and measurements: Make all Shop Drawings accurately to a scale sufficiently large to show all pertinent aspects of the item and its method of connection to the Work.

2.2.1.2 Type of prints required: Submit all Shop Drawings in the form of one sepia transparency of each sheet plus one blue line or black line print of each sheet. Blueprints will not be acceptable.

2.2.1.3 Reproduction of review Shop Drawings: Printing and distribution of review Shop Drawings for the Architect's use will be by the Architect. All review comments of the Architect will be shown on the sepia transparency when it is returned to the Contractor. The Contractor shall make and distribute all copies required for his purposes.

## 2.3 MANUFACTURER'S LITERATURE

2.3.1 Genera1: Where contents of submitted literature from manufacturers include data not pertinent to the submittal, clearly indicate which portion of the contents is being submitted for review.

2.3.2 Number of copies required: Submit the number of copies which are required to be returned plus two copies which will be retained by the Architect.

## 2.4 SAMPLES

2.4.1 Accuracy of samples: Samples shall be of the precise article proposed to be furnished.

2.4.2 Number of samples required: Unless otherwise specified, submit all samples in the quantity which is required to be returned plus one which will be retained by the Architect.

2.4.3 Reuse of Samples: In situations specifically so approved by the Architect, the Architect's retained Sample may be used in the construction as one of the installed items.

## 2.5 COLORS AND PATTERNS

Unless the precise color and pattern is specifically described in the Contract Documents, and whenever a choice of color or pattern is available in a specified product, submit accurate color and pattern charts to the Architect for review arid selection.

## 2.6 SUBSTITUTIONS

2.6.1 Approval required:

2.6.1.1 The Contract is based on the standards of quality established in the Contract Documents.

2.6.1.2 All products proposed for use, including those specified by required attributes and performance shall require approval by the Architect before being incorporated into the work.

2.6.1.3 Do not substitute materials, equipment, or methods unless such substitution has been specifically approved for this Work by the Architect.

2.6.2 "Or equal":

2.6.2.1 Where the phrase "or equal" or "or equal as approved by the Architect" occurs in the Contract Documents, do not assume that materials, equipment, or methods will be approved as equal unless the item has been specifically approved for this Work by the Architect.

2.6.2.2 The decision of the Architect shall be final.

# PART III EXECUTION

## 3.1 IDENTIFICATION OF SUBMITTALS

3.1.1 General: Consecutively number all submittals. Accompany each submittal with a letter of transmittal containing all pertinent information required for identification and checking of submittals.

3.1.2 Internal identification: On at least the first page of each copy of each submittal, and elsewhere as required for positive identification, clearly indicate the submittal number in which the item was included.

3.1.3 Re-submittals: When material is resubmitted for any reason, transmit under a new letter of transmittal and with a new submittal number.

3.1.4 Submittal log: Maintain an accurate submittal log for the duration of the Contract, showing current status of all submittals at all times. Make the submittal log available for the Architect's review upon request.

## 3.2 COORDINATION OF SUBMITTALS

3.2.1 General: Prior to submittal for approval, use all means necessary to fully coordinate all material including, but not necessarily limited to:

(1) Determine and verify all interface conditions, catalog numbers, and similar data.

(2) Coordinate with other trades as required.

(3) Clearly indicate all deviations from requirements of the Contract Documents.

3.2.2 Grouping of submittals: Unless otherwise specified, make all submittals in groups containing all associated items to ensure that information is available for checking each item when it is received. Partial submittals may be rejected as not complying with the provisions of the Contract Documents and the Contractor shall be strictly liable for all delays so occasioned.

## 3.3 TIMING OF SUBMITTALS

3.3.1 General: Make all submittals far enough in advance of scheduled dates for installation to provide all time required for reviews, for securing necessary approvals, for possible revisions and re-submittals, and for placing orders and securing delivery.

3.3.2 Architect's review time: In scheduling, allow at least 10 calendar days for review by the Architect following his receipt of the submittal.

3.3.3 Delays: Delays caused by tardiness in receipt of submittals will not be an acceptable basis for extension of the Contract completion date.

## 3.4 ARCHITECT'S REVIEW

3.4.1 General: Review by the Architect shall not be construed as a complete check, but only that the general method of construction and detailing is satisfactory. Review shall not relieve the Contractor from responsibility for errors which may exist.

3.4.2 Authority to proceed: The notations "Reviewed, no exceptions noted" or "Reviewed, exceptions noted" authorize the Contractor to proceed with fabrication, purchase, or both, of the items so noted, subject to the revisions, if any, required by the Architect's review comments.

3.4.3 Revisions: Make all revisions required by the Architect. If the Contractor considers any required revision to be a change, he shall so notify the Architect as provided for under "Changes" in the General Conditions. Show each drawing revision by number, date, and subject in a revision block on the drawing. Wake only those revisions directed or approved by the Architect.

3.4.4 Revisions after approval: When a submittal has been reviewed by the Architect, re-submittal for substitution of materials or equipment will not be considered unless accompanied by an acceptable explanation as to why the substitution is necessary.

**END OF SECTION**

**SECTION 01310**
**CONSTRUCTION SCHEDULE**

## PART I GENERAL

### 1.1 DESCRIPTION

1.1.1 Work included: To assure adequate planning and execution of the Work so that the Work is completed within the number of calendar days allowed in the Contract, and to assist the Architect in appraising the reasonableness of the proposed schedule and in evaluating progress of the Work, prepare and maintain the schedules and reports described in this Section.

1.1.2 Definitions:

(1) "Day" used throughout the Contract, unless otherwise stated, means "calendar day".

### 1.2 QUALITY ASSURANCE

1.2.1 Qualifications of scheduling personnel: Employ a scheduler who is thoroughly trained and experienced in compiling construction schedule data, in analyzing by use of Critical Path Method or PERT, and in preparation and issue of periodic reports as required below.

1.2.2 Reference standards: Perform all data preparation, analysis, charting, and updating in accordance with all recommendations contained in the current edition of "CPM In Construction" manual of Associated General Contractors, or in accordance with other standards approved by the Architect.

1.2.3 Reliance upon approved schedule:

1.2.3.1 The construction schedule as approved by the Architect will be an integral part of the Contract, and will establish interim Contract completion dates for the various activities.

1.2.3.2 Should any activity not be completed within 15 days after the stated scheduled date, the Architect shall have the right to order the Contractor to expedite completion of the activity by whatever means the Architect deems appropriate and necessary, without additional compensation to the Contractor.

1.2.3.3 Should any activity be 30 or more days behind schedule, the Architect shall have to right to perform the activity or have the activity performed by whatever method the Architect deems appropriate.

1.2.3.4 Costs incurred by the Architect in connection with expediting construction activity under this Article shall be reimbursed to the Architect by the Contractors.

1.2.3.5 It is expressly understood and agreed that failure by the Architect to exercise the option to either order the Contractor to expedite an activity or to expedite the activity by other means shall not be considered precedent setting for any other activities.

## 1.3 SUBMITTALS

1.3.1 General: Comply with the provisions of Section 01300.

1.3.2 Preliminary analysis: Within ten days after receipt of Notice to Proceed, submit one reproducible copy and four prints of a preliminary construction schedule, plus four prints of proposed format for Materials Status Reports, prepared in accordance with Part Three of this Section.

1.3.3 Construction schedule: Within 30 days after receipt of Notice to Proceed, submit one reproducible and four prints of construction schedule prepared in accordance with Part Three of this Section.

1.3.4 Periodic reports:

1.3.4.1 On the first working day of each month following submittal described in Paragraph 1.3.3. above, submit four prints of the construction schedule updated as described in Part Three of this Section.

1.3.4.2 Accompanying each periodic submittal of construction schedule, submit four prints of the Materials Status Reports updated as described in Part Three of this Section.

# PART II PRODUCTS

## 2.1 CONSTRUCTION ANALYSIS

2.1.1 Diagram:

2.1.1.1 Graphically show the order and interdependence of all activities necessary to complete the Work, and the sequence in which each activity is to be accomplished, as planned by the Contractor and his project field superintendent in coordination with all subcontractors whose work is shown on the diagram. Activities shown on the diagram shall include, but are not necessarily limited to:

(1) Project mobilization.

(2) Submittals and approvals of Shop Drawings and Samples.

(3) Procurement of equipment an critical materials.

(4) Fabrication of special material and equipment, and their installation and testing.

(5) Final cleanup.

(6) Final inspection and testing.

(7) All activities by the Architect that affect progress, required dates for completion, or both, for all and for each part of the Work.

2.1.1.2 The detail of information shall be such that duration times of activities shall normally range from one to 15 days. The selection and number of activities shall be subject to the Architect's approval.

2.1.1.3 Show on the diagram, as a minimum for each activity, precedent and following event numbers, description of each activity, cost, and activity duration in calendar days. Submit diagram on a sheet 75 cm (30") high by the width required.

2.1.2 Mathematical analysis:

2.1.2.1 Furnish a mathematical analysis of the diagram by manual or computer-aided means, including a tabulation of each activity. Show the following information as a minimum for each activity:

(1) Preceding and following event numbers.

(2) Activity description.

(3) Estimated duration of activities.

(4) Earliest start date (by calendar date).

(5) Latest start date (by calendar date).

(6) Earliest finish dated (by calendar date).

(7) Latest finish date (by calendar date).

(8) Slack or float (in calendar days).

(9) Monetary value of the activity.

(10) Percentage of activity completed.

(11) Contractor's earnings based on portion of activity completed.

2.1.2.2 The means used in making the mathematical analysis shall be capable of compiling the total value of completed and partially completed activities, and be capable of accepting modifications approved for time and logic adjustment.

2.1.3 Periodic reports:

2.1.3.1 If computer-aided means are used, list the activities in computer printout sorts as follows:

(1) By the preceding event number from lowest to highest, and then in order of the following event number.

(2) By the amount of float, then in order of preceding event numbers, and then in order of succeeding event numbers.

(3) In order of preceding event numbers, and then in order of succeeding event numbers (show the dollar amount and dollars spent to date for each activity).

(4) Other sorts requested by the Architect, for which the Contractor will be reimbursed in accordance with the General Conditions provisions for Architect.

2.1.3.2 If computer-aids are not used, provide equivalent information to the approval of the Architect.

## 2.2 MATERIALS STATUS REPORTS

2.2.1 Format: The Contractor's standard materials status report form will be acceptable if, in the Architect's judgment, it provides sufficient pertinent data to determine that materials procurement flow is adequate for all needs of the Work.

2.2.2 Content: Show at least the following information:

(1) Item description, listed in accordance with Specifications Section number in which the item is called for.

(2) Purchase Order number and date of issue.

(3) Vendor name.

(4) Date shipped, and shipping means utilized.

(5) Estimated date of arrival at job site.

(6) Actual date of arrival at job site, and receiving report number.

2.2.3 Data processing: Process the data by manual or computer-aided methods, but to a degree of promptness and accuracy assuring complete display of all pertinent current information at date of each periodic report.

## PART III EXECUTION

### 3.1 PRELIMINARY ANALYSIS

3.1.1 Contents:

(1) Show all activities of the Contractor under this Work for the period between receipt of Notice to Proceed and submittal of construction schedule required under Paragraph 1.3.3 above.

(2) Show the Contractor's general approach to remainder of the Work.

(3) Show cost of all activities scheduled for performance before submittal and approval of the construction schedule.

3.1.2 Submittal shall be in accordance with Paragraph 1.3.2 above.

### 3.2 CONSTRUCTION SCHEDULE

As soon as practicable after receipt of Notice to Proceed, complete the construction analysis described in Articles 2.1 and 2.2 above, in preliminary form. Meet with the Architect, review contents of proposed construction schedule, and make all revisions agreed upon. Submit in accordance with Paragraph 1.3.3 above.

### 3.3 MATERIAL STATUS REPORTS

As soon as practicable after receipt of Notice to Proceed, meet with the Architect, review contents of proposed Materials Status Reports, and make all revisions to format agreed upon.

## 3.4 PERIODIC REPORTS

3.4.1 Construction schedule:

3.4.1.1 Contents:

(1) Report actual progress by updating the mathematical analysis.

(2) Note on the summary report, or clearly show on a revised issue of affected portions of the detailed diagram, all revisions causing changes in the detailed program.

(3) Revise the summary report as necessary for clarity.

(4) Show activities or portions of activities completed during the reporting period, and their actual value.

(5) State the percentage of Work actually completed and schedule as of the report date, and the progress along the critical path in terms of days ahead of or behind the allowable dates.

(6) If the Work is behind schedule, also report progress along other paths with negative slack.

(7) Include a narrative report which shows, but is not necessarily limited to:

a. A description of the problem areas, current and anticipated.

b. Delaying factors and their impact.

c. An explanation of corrective actions taken or proposed.

3.4.1.2 Show the date of latest revision. Submit in accordance with the provisions of subparagraph 1.3.4.1 above.

3.4.2 Materials Status Reports:

3.4.2.1 On the letter of transmittal accompanying periodic reports, on an accompanying summary sheet, or by other means acceptable to the Architect, clearly indicate those items the deliveries of which are critically overdue or otherwise hazardous to maintenance of the approved schedule.

3.4.2.2 Submit in accordance with the provisions of subparagraph 1.3.4.2 above.

## 3.5 REVISIONS

Make only those revisions to approved construction schedule and approved Materials Status Reports as are approved in advance by the Architect.

**END OF SECTION**

**Section 01 35 45 – Environmental Protection During Construction**

**Part 1 – General**

**1.1 Summary**
This section addresses required environmental and safety measures to protect existing asbestos-containing materials (ACM) in the freight elevator lobby during construction activities.

**1.2 Asbestos-Containing Material – Freight Elevator Lobby**

- Existing **12" x 12" vinyl floor tiles** at the **freight elevator lobby** have been identified or are assumed to contain **asbestos**.
- These tiles are to **remain in place** and shall **not be disturbed, removed, cut, drilled, sanded, or abraded** under any circumstance during demolition or construction activities.

**1.3 Contractor Responsibilities**

- **Demarcate and protect** the area of asbestos-containing flooring with **warning signage** and **temporary protective floor covering** such as 1/4" plywood or walk-off mats, as appropriate.
- All **equipment traffic, material staging, and demolition debris** shall be **kept off the asbestos tile area** unless protective covering is in place.
- Contractor shall **coordinate all work in the vicinity** to ensure compliance with federal, state, and local asbestos regulations (e.g., **EPA NESHAP**, **OSHA 29 CFR 1926.1101**, and **local environmental regulations**).
- Prior to start of work, **conduct a safety briefing** with all workers addressing this restriction and the penalties for non-compliance.

**1.4 Submittals**

- Submit a **written protection plan** for work adjacent to the asbestos flooring, including:
    - Floor protection method,
    - Worker training compliance,
    - Emergency response plan in case of accidental disturbance.
- Submit **daily photographic documentation** showing that protection is in place prior to commencing work in affected areas.

**1.5 Compliance and Notification**

- Any **accidental disturbance or damage** to the asbestos tiles must be **reported immediately** to the Owner and Environmental Consultant.

- Work in the affected area shall be **halted until a licensed abatement contractor** has assessed and remediated the situation, at the Contractor’s cost.

# SECTION 01380
# CONSTRUCTION PHOTOGRAPHS

## PART I GENERAL

### 1.01 DESCRIPTION OF REQUIREMENTS

A. Definitions: Construction photographs required by this section are intended to provide a visual record of construction progress at regularly scheduled intervals. They provide a means of confirming visually the status of work, insofar as photographed, on the dates recorded on photographs. They are to be used together with other recorded indication of work progress in determining questions which may arise.

### 1.02 RESPONSABILITIES

A. General: Contractor shall engage a commercial photographer to take color photographs during construction, in the number, times and locations indicated, and to submit prints as indicated.

B. Associated Services: Cooperate with photographer's work at site. Provide auxiliary services as may be reasonably requested, including access and use of temporary facilities including temporary lighting.

### 1.03 PHOTOGRAPHIC REQUIREMENTS

A. General: Except as additionally required, take 3 sets of 8 project photographs at monthly intervals, coinciding with work cutoff date associated with each monthly payment request. Photographer shall select vantage point for each shot each month so as to best show status of construction and work progress since taking previous photographs.

B. Vantage Points: Comply with Architect's directions from time to time, concerning desired vantage points for shots.

C. Omitted

### 1.04 SUBMITTALS

A. General: Refer to Division-1 section of "Submittals" for general requirements of submitting photographs. Submit prints of construction photographs, directly to Architect within 5 days of shot (exposure). Architect will distribute to Owner two prints as Owner's permanent record.

B. Photographer shall retain photographic negatives of submitted photographs, for a period of 3 years after date of substantial completion; and prior to end of 3 years period shall fill orders by Architect for extra photographic prints, priced at prevailing commercial prices.

## PART II PRODUCTS

### 2.01 PHOTOGRAPHIC COPIES

A. General: Provide 8" by 10" glossy color prints on single-weight commercial-grade stock, with extra 1/2" wide margin punched for standard 3-ring binder. Place margin on left edge of vertical shots and at top of horizontal shots. Identify each print on back side by mark-up of either an applied label or a rubber stamped impression; provide the following information:

Name/address of photographer
Name of Project
Date of shot (exposure)
Description of vantage point, in terms of location, direction and elevation or story of construction.

## PART III EXECUTION

NOT USED

**END OF SECTION**

# SECTION 01400
# QUALITY CONTROL

## PART I GENERAL

### 1.01 SURVEYS AND LAYOUT

A. The Contractor shall provide the services of qualified personnel, during the contract period, for layout of lines and elevations of buildings and structures including foundation systems, footings and piers, floor and roof systems, pavements, sidewalks, grading, utilities, and landscaping.

### 1.02 INSPECTION AND TESTING AGENCIES

A. The Contractor shall pay all costs and arrange for a testing agency to provide on site testing of-soil compaction, concrete and other items as specified herein. The tests shall be fully documented and certified.

B. Individuals performing inspection and testing must be certified by an organization whose certification program is recognized by the jurisdiction involved and is acceptable to the Owner.

### 1.03 COORDINATION

A. Each subcontractor shall cooperate fully with the inspection and testing required.

B. Subcontractor shall not assume to use the testing by this Section as being adequate. Each subcontractor shall maintain his own quality methods in addition to the required testing.

### 1.04 INSPECTIONS

A. At least twenty four hours shall be allowed for inspection prior to any test or concrete placement. The inspection will be made after notification that all items have been installed for the test or preparatory for concrete placement. Should the inspection reveal that corrective measures are required or that the work is not complete, and additional twenty four hours will be allowed to complete the inspection after all work has been corrected or completed.

B. Notification shall be given at least twenty four hours in advance of backfilling encasing of any underground utility in order that an inspection may be made of the installation. Failure to provide such notification may require reopening of the trench at the Contractor's expense.

## 1.05 ACCEPTANCE OF SUBSTRATES

A. Work of the various sections shall not begin until the installing contractor has examined the substrates and has determined that they are acceptable. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the installer. Notice of unsatisfactory conditions shall be given to the Contractor in writing. Proceeding with the work shall indicate acceptance of the substrate by that installer or Contractor.

**END OF SECTION**

# SECTION 01410
# TESTING LABORATORY SERVICES

## PART I GENERAL

### 1.1 DESCRIPTION

1.1.1 Work included: Provide all materials, facilities, services, and other items needed and perform all inspecting and testing required under pertinent other Sections of these Specifications.

1.1.2 Related work described elsewhere: Individual requirements for testing are defined in the pertinent other Sections of these Specifications.

1.1.3 Work not included in this section: Inspecting and testing performed by the Architect and by the Owner.

### 1.2 QUALITY ASSURANCE

1.2.1 Qualifications of testing laboratory: Select a testing laboratory qualified in accordance with ASTM E329 "Recommended Practice for Inspection and Testing Agencies for Concrete and Practice for Inspection and Testing Agencies for Concrete and Steel Used in Construction" and approved by the Architect.

1.2.2 Codes and standards: Testing, when required, shall be in accordance with all pertinent codes and regulations and with the specified standards.

1.2.3 Qualifications of personnel: For actual inspecting and testing, use only personnel who are thoroughly trained and experienced in the necessary skills, completely familiar with the requirements specified, the pertinent portions of the Contract Documents, and the selected standards for inspecting and testing; and who are approved for this purpose by the Architect.

### 1.3 SUBMITTALS

1.3.1 Proposed testing laboratory: Within 30 days after award of Contract, submit complete data relative to the testing laboratory proposed for this Work. Show all data needed for review.

1.3.2 Proposed testing personnel: Accompanying the data required under Paragraph 1.3.1 above, submit brief biographies of all personnel the Contractor proposes to employ for testing and inspecting under the Contract.

1.3.3 Schedule for inspecting and testing:

1.3.3.1 Accompanying the data required under Paragraph 1.3.1 above, submit the schedule described in Paragraph 2.1 below.

1.3.3.2 Submit proposed revised schedules in adequate time to permit proper rescheduling of the Architect's activities in connection with inspection and tests.

## 1.4 PRODUCT HANDLING

Promptly process and distribute all required copies of test reports and related instructions to ensure necessary retesting, replacement of materials, or both, as required, and with the least possible delay in progress of the Work.

# PART II PRODUCTS

## 2.1 SCHEDULES FOR INSPECTING AND TESTING

2.1.1 General: Prepare a master schedule of all items to be inspected and all items to be tested. By coordination with the construction schedule, establish tentative dates for each such activity.

2.1.2 Architect's review: Submit this data in preliminary form for the Architect's review. Meet with the Architect as required to arrive at mutually acceptable revisions. Make the agreed upon revisions and submit as required under Paragraph 1.3.3.1 above.

2.1.3 Revisions:

2.1.3.1 Maintain the schedule for testing and inspecting to accurately reflect progress of the Work.

2.1.3.2 Do not decrease the inspecting and testing activity without written permission from the Architect.

2.1.3.3 Submit all proposed schedule revisions as described in subparagraph 1.3.3.2.

## 2.2 TESTING LABORATORY FACILITIES

Provide all testing laboratory facilities required to satisfactorily perform the testing required under pertinent other Sections of these Specifications and within the increments of time essential to timely completion of the Work.

## PART III EXECUTION

### 3.1 COOPERATION WITH TESTING LABORATORY

Representatives of the testing laboratory shall have access to the Work at all times. Provide facilities for such access in order that the laboratory may properly perform its function.

### 3.2 CONDUCT OF TESTING

For actual testing, and reporting of tests, use only those personnel and methods approved in advance by the Architect.

### 3.3 CONDUCT OF INSPECTING

3.3.1 Notification: To permit the Architect to witness inspections where the Architect so desires, notify the Architect not less than 24 hours in advance when inspection will not be performed as scheduled.

3.3.2 Reimbursement of Architect costs: When Architect has dispatched personnel to witness inspecting or testing, and the inspecting or testing has been delayed without proper notification to the Architect, reimburse all Architect's costs arising by virtue of lack of notification.

### 3.4 ALTERNATIVE INSPECTION PROCEDURE

The Architect shall have the right to require alternative inspection procedure other than those specified when, in the Architect's opinion, such is required to demonstrate compliance with Contract requirements. Costs of inspection will be borne by the Owner if products are found to comply, otherwise costs shall be borne by the Contractor.

### 3.5 TESTS REPORTS

All test reports shall be signed by the individual so authorized in the testing plan approved by the Architect.

**END OF SECTION**

# SECTION 01500
# TEMPORARY FACILITIES AND CONTROLS

## PART I GENERAL

### 1.1 DESCRIPTION

1.1.1 Work Included: Temporary facilities and controls required for this Work include, but are not necessarily limited to:

(1) Temporary utilities such as water, electricity, and telephone.

(2) Field offices and sheds.

(3) Sanitary facilities.

(4) Enclosures such as tarpaulins, barricades, and canopies.

(5) Fencing of the construction area.

(6) Haul roads.

1.1.2 Related work described elsewhere:

(1) Except that all equipment furnished by subcontractors shall comply with all requirements of pertinent safety regulations, the ladders, planks, hoists, and similar items normally furnished by the individual trades in execution of their own portions of the Work are not part of this Section.

(2) Permanent installation and hook-up of the various utility lines are described in the pertinent other Sections of these Specifications.

### 1.2 PRODUCT HANDLING

Use all means necessary to maintain temporary facilities and controls in proper and safe condition throughout progress of the Work.

### 1. 3 JOB CONDITIONS

Make all required connections to existing utility systems with minimum disruption to services in the existing utility systems. When disruption of the existing service is required, do not proceed without the Architect's approval and, when required, provide alternate temporary service.

## PART II PRODUCTS

## 2.1 UTILITIES

2.1.1 General: All temporary facilities shall be subject to the Architect's approval.

2.1.2 Water:

2.1.2.1 Furnish and install all necessary temporary water lines and water supply and, upon completion of the Work, remove all such temporary facilities,

2.1.2.2 The contractor will furnish all water needed for construction.

2.1.3 Electricity:

2.1.3.1 Furnish and install all necessary temporary wiring and, upon completion of the Work, remove all such temporary facility.

2.1.3.2 Furnish and install area distribution boxes so located that the individual trades may use 30 m (100') maximum length extension cords to obtain adequate power and artificial lighting at all points where required for the Work, for inspection and for safety.

2.1.3.3 Contractor will furnish all electricity needed for construction.

2.1.5 Telephone: Make all necessary arrangements and pay all costs for operation and installation of telephone service to the contractor's office at the site.

2.1.6 Utilities for testing: Normal quantities of utilities required to make final tests of completely installed permanent systems will be furnished at no cost to the Contractor.

## 2.2 FIELD OFFICES AND SHEDS

2.2.1 Contractor's facilities:

2.2.1.1 Provide a field office building and sheds adequate in size and accommodation for all Contractor's offices, supply and storage.

2.2.1.2 Within the Contractor's facilities, provide enclosed space adequate for holding weekly project meetings. Furnish with all required tables, chairs, and utilities.

2.2.1.3 The entire facility, including furniture, will remain the property of the Contractor and shall be removed from the site after completion of the Work.

2.2.1.4 Sanitary facilities: Provide temporary sanitary facilities in the quantity required, for use of all personnel. Maintain in a sanitary condition at all times.

## 2.3 ENCLOSURES

Furnish, install, and maintain for the duration of construction all required scaffolds, tarpaulins, barricades, canopies, warning signs, steps, bridges, platforms, and other temporary construction necessary for proper completion of the Work in compliance with all safety and other regulations.

## 2.4 PROJECT SIGNS

Allow no signs or advertising of any kind on the job site except as specifically approved in advance by the Architect.

## 2.5 FENCING OF THE CONSTRUCTION AREA

2.5.1 General: Furnish and install a temporary fence around construction areas on the site.

2.5.2 Construction: The temporary fence shall consist of woven wire mesh not less than 1.82 m (72") in height, complete with metal posts and all required bracing, and with truck and pedestrian gates as required.

## 2.6 HAUL ROADS

Provide and maintain all required access to the Work from paved areas and other routes, in strict accordance with all regulations governing the Contractor's use of the site.

# PART III EXECUTION

## 3.1 MAINTENANCE AND REMOVAL

Maintain all temporary facilities and controls as long as needed for the safe and proper completion of the Work. Remove all such temporary facilities and controls as rapidly as progress of the Work will permit, or as directed by the Architect.

**END OF SECTION**

M -110

FIELD OFFICE

SECTION M – 110

Field Office and Sheds

## Part 1 - General

### 1.01. Description

A. Furnish, install and maintain temporary a suitable and waterproof field office for use of PRPA and Resident Engineer during entire construction period.

B. Field offices for use of PRPA and Resident Engineer shall be identified with signs and logos. Trailer for exclusive use of project manager, resident inspector and PRPA engineers during site visits.

C. Furnish, install and maintain storage and works sheds needed for construction.

D. Prior to installation of offices and sheds, coordinate location, access and related facilities with PRPA Architect/Engineer.

E. At completion of works, remove field offices, sheds and their contents.

### 1.02. Requirements

A. Construction:

1. Provide facilities that are structurally sound, watertight in like new condition and with floor raised above ground.

2. Temperature Transmission Resistance: Provide insulation compatible with occupancy and storage requirements.

3. At Contractor's option, use portable of mobile buildings.

4. Lighting: 50 foot-candles at desk top height.

5. Exterior lighting at entrance door.

6. Size: **40' x 12' Office trailer with two (2) private offices, one (1) conference area and one (1) toilet**

7. Lighting: 50 foot-candles at desk top height.

8. Exterior lighting at entrance door.

9. Automatic mechanical cooling equipment to maintain comfort conditions.

10. Minimum of four (4) 120 volt duplex electric convenience outlets, at least one on each wall. (see plan)

11. Electric distribution panel: Two circuits minimum, 110 volt 60 hertz service.

12. Anchoring System for Mobile or Portable Buildings: Sufficient to withstand hurricane force winds and meeting code.

13. Meeting Area Furnishings:

    a. Conference table and chairs for at least eight (8) person

b. Racks and files for Project Records Documents in, or adjacent to the meeting area.

c. Other Furnishing: Contractor's options.

14. Health Service: Water and Sanitary facilities.

15. Janitor Service: Daily.

16. Internet Connection: Provide and install a DSL internet wireless service account for the period of the project.

17. Computer equipment: Provide the following equipment including installation of software and set up (at the completion of the project, the equipment listed will be returned to the Contractor):

1 ea. **Desktop Computer** (recent technology), DVD/CD Rewritable, with following software installed: Windows latest version, MS Office Professional (latest version) and Adobe Acrobat Professional (latest version), MS Project (latest version)

1 ea. **Photo Quality Color Inkjet Printer** (printer, copier, fax & scanner). Provide ink cartridges as necessary to maintain proper functioning of equipment. Format 11x17 and 8.5 x 11

18. Storage Sheds:

- To meet requirements of various trades.
- Dimensions: Adequate for storage and handling of products.
- Ventilation: Comply with specified and code requirements for products stored.

19. Other Equipment:

2 ea. Computer Desk

2 ea. Desks 30" x 60"

2 ea. Chairs, swivel-desk

2 ea. Chairs straight-arm (visitor's chair)

1 ea. Conference table and chairs for at least eight (8) persons

1 ea. Lateral filing cabinets, 4 drawer, legal size

2 ea. Filing trays, desk type, 5 tier, legal size

2 ea. Wastebaskets

1 ea. Rack, wall, plan, 12-plan capacity

1 ea. Refrigerator

1 ea. Water cooler, electric (necessary 5 gallon reservoir refills)

1 ea. Coffee maker/dispenser, with cups

1 ea. Microwavable oven

As required: lamps, desk, shelves, windows shades and bathroom supplies.

20. Permits: general contractor shall fill and paid required state or federal permits for the temporary installation, occupancy and water / power provision of services of this trailer on job site.

## Part 2 – Products

2.01. Materials, Equipment, and Furnishings: New or used, serviceable, adequate for required purpose, and that do not violate applicable codes or regulations.

## Part 3 – Execution

### 3.01. Installation

A. Fill and grade sites for temporary structures as necessary to provide surface drainage.
B. Construct temporary field offices and storage sheds on proper foundations. provide connections for utilities services.
    - Secure portable or mobile buildings, when used, against break-ins and hurricane force winds per code.
    - Provide steps and landings at entrance doors.

### 3.02. Maintenance and Cleaning

A. Provide periodic maintenance and cleaning for temporary structures, furnishings, equipment and services.

### 3.03. Removals

A. Remove temporary field offices, contents and services when no longer needed.

B. Remove storage sheds when no longer needed.

C. Remove foundations and debris, grade site to specified elevations and complete remaining site work indicated on Drawings.

End of Section

## General Description

- Office Trailers provide temporary or permanent office space for a variety of industries and uses.
- Standard size units 12’ x 40’
- 480 square feet of interior space.

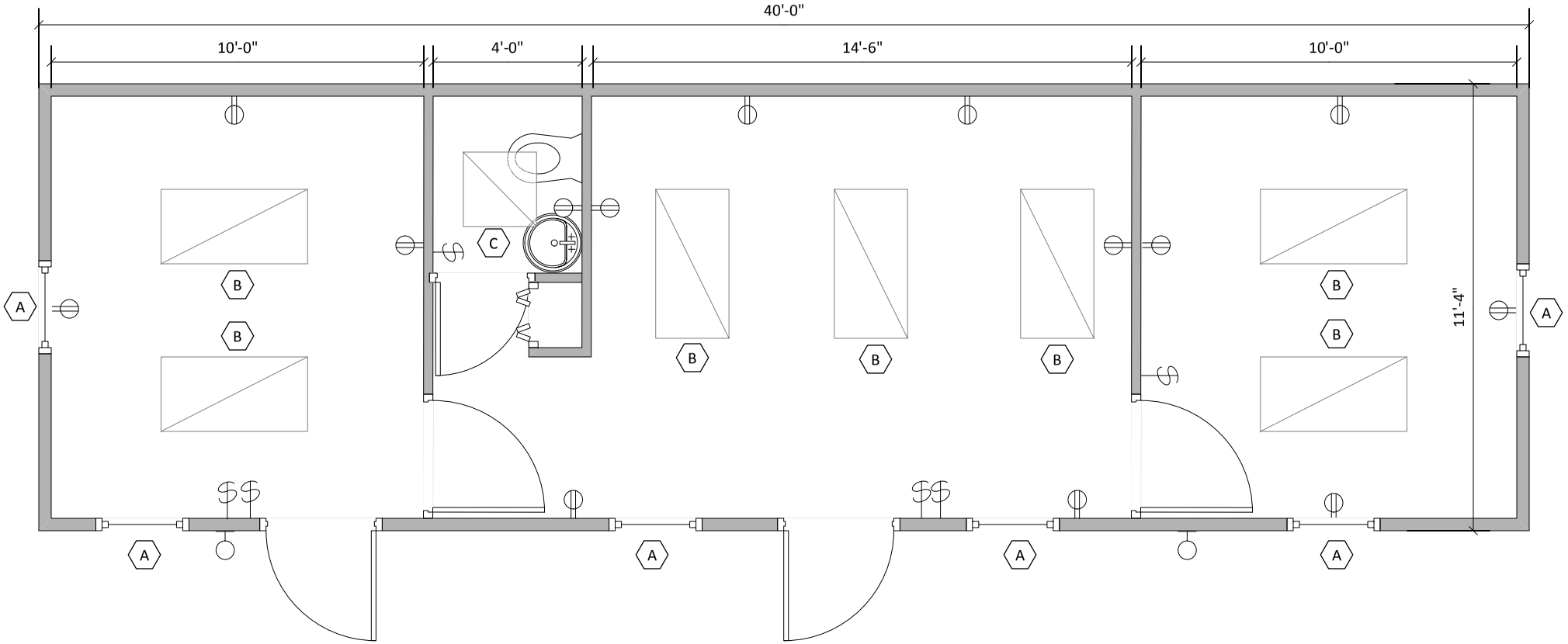
## Specs & Features

- Paneled interior walls
- New Vinyl tile
- Gypsum ceiling - 8’ceiling height
- Fluorescent lighting
- Horizontal sliding glass windows
- HVAC System
- Junctions Boxes for Data/Voice connections
- .024 gauge Aluminum siding
- Gutter trim channels
- 36”x80” exterior door w/ lock
- Exterior lighting
- Bathroom










## Leyenda:

| | |
|---|---|
| A 6 Ventanas 30"x60" | Piso Vinyl (linoleo) |
| B 7 Lámparas 2'x4' | 2 Puertas Valiance 36"x80" |
| | 3 A/C Nuevos (2-12,000 BTU; 1-18,000 BTU |
| C 1 Lámparas 2'x2' | 4 Interruptores (2 Individuales; 2 Dobles) |
| 14 Receptáculos 120v | ½ Baño (Inodoro, Lavamanos y Closet) |
| 2 Receptáculos 240v | 2 Luminarias para Exterior |

**Proyecto-Auxiliary-Cargo-Ramp-San-Ildefonso-Culebra**m

# Trailer 12'x40'

marzo 15, 2017

SECTION 01505

MOBILIZATION

PART 1 GENERAL

1.01 DESCRIPTION

A. The work specified in this Section shall consist of the preparatory work and operations in mobilizing for beginning work on the Project, including, but not limited to, the following:

(1) The costs of bonds and any required insurance, and any other preconstruction expense necessary for the start of the work, excluding the cost of construction materials;

(2) The costs of operations necessary for the movement of personnel, equipment, supplies and incidentals to the project site; and

(3) The costs for the establishment of temporary offices, shops, buildings, construction identification signs, safety equipment and first aid supplies, sanitary and other facilities, as required by the Contract Documents, and any Federal, State and/or local laws and regulations.

B. The Contractor shall prepare and submit to the Field Representative detailed itemized cost breakdown of this item, at the preconstruction conference.

1.02 The Contractor shall include in the Schedule of Values a line item for "Mobilization".

1.03 Not used.

1.04 PARTIAL PAYMENTS

Partial payments for Mobilization will be made in accordance with the following schedule during the progress of construction on this project.

| Percent of Original Contract Amount Earned | Allowable Percent of the Lump Sum Price for Mobilization* |
|---|---|
| 5 | 25 |
| 10 | 50 |
| 25 | 75 |
| 50 | 100 |

Partial payments for the item "Mobilization" shall be made in accordance with the above schedule and the sum total of all the partial payments for the item Mobilization will be limited to 3% of the original Contract Amount for the Project. Any remaining amount will be paid upon completion of all work under the Project.

The standard retainage, as specified in General Conditions, will be applied to these allowances. Partial payments made on this item shall in no way act to preclude or limit any of the provisions for partial payments otherwise provided for by the Contract.

## 2.0 PRODUCTS

### 2.01 PROJECT IDENTIFICATION SIGNS

A. Provide specified number of project identification sign(s) per Section 01580. The name, address and contact information of the general contractor for the project shall be shown on the sign per Section 01580 and the attached exhibit.

## 3.0 EXECUTION

### 3.01 PLACEMENT OF PROJECT IDENTIFICATION SIGNS

A. Place a Project Identification Sign as described in Section 01580, part 1.03, D visible to passing traffic or as directed by Engineer.

END OF SECTION

## Section 01 56 00 – Temporary Barriers and Security During Construction

### Part 1 – General

**1.1 Summary** This section outlines the requirements for temporary fire-rated barriers and security protocols during elevator modernization work.

### 1.2 Temporary Fire-Rated Barrier Requirements

- Provide a **UL-classified fire-rated partition** at each elevator entrance affected by modernization work.
- Barrier must extend **from finished floor to underside of floor slab or deck above** to ensure full-height containment.
- Partition assembly shall be:
  - **Dust-proof** and **vapor-proof**;
  - Constructed of **non-combustible materials**;
  - Designed to resist air and dust infiltration under negative or positive pressure conditions.
- Install **dust-trapping floor mats** at all access points to the work zone and **maintain daily**.

### 1.3 Security and Access Control

- Contractor shall **secure the construction zone** with locked access panels or doors where necessary.
- Maintain **clear and secure access** for PRIDCO personnel at all times to the following areas:
  - **Janitor Room**;
  - **HVAC Mechanical Room**;
  - **Administrative or Office Spaces** directly adjacent to or impacted by construction activities.
- Coordinate with Owner to establish and maintain approved **access routes**, including **signage and protective walkways**, if required.
- All access routes must be **clearly marked, well-lit, and kept free of obstructions and hazards**.

### 1.4 Safety Compliance

- Temporary partitions must comply with **NFPA 241**, local fire code, and OSHA standards.

- Contractor shall post appropriate **warning signage** and **emergency contact information** at entry points.
- Any modification to life safety systems or building egress must be coordinated with the Owner and approved by the Authority Having Jurisdiction (AHJ).

### 1.5 Submittals

- Submit drawings showing proposed barrier location, material specifications, and access control strategy.
- Submit daily inspection logs verifying the integrity and cleanliness of dust protection systems and access controls.

### 1.6 Warranty of Access

- Contractor shall guarantee **uninterrupted access** to designated areas for Owner’s personnel throughout the construction period.
- Any temporary closures or detours must be pre-approved by the Owner at least **72 hours in advance**.

# SECTION 01560
# ENVIRONMENTAL CONTROLS

## PART I GENERAL

### 1.01 REQUIREMENTS

A. Provide and maintain environmental control during the life of the contract. Environmental control shall be provided to correct conditions that develop during the construction of permanent environmental protection features or that are required to control pollution that develops during normal construction practices but are not associated with permanent control features incorporated in the project. The Contractor's operations shall comply with all federal and state regulations pertaining to water, air, solid waste and noise pollution.

### 1.02 DEFINITIONS OF CONTAMINANTS

A. Sediment

Soil and other debris that has been eroded and transported by runoff water.

B. Solid Waste

Rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial and agricultural operations and from community activities.

C. Rubbish

A variety of combustible and noncombustible wastes, such as ashes, waste materials that result from construction work, leaves and tree trimmings.

E. Chemical Waste

Includes petroleum products, bituminous materials, slats, acids, alkalies, herbicides, pesticides, organic chemicals and inorganic wastes.

F. Sanitary Wastes

1. Sewage – That which is considered as domestic sanitary sewage.

2. Garbage – Refuse and scraps resulting from preparation, cooking, dispensing and consumption of food.

## 1.03 PROTECTION OF NATURAL RESOURCES

A. Confine construction activities to areas defined by work description, plans and specifications. Preserve in their existing condition or restore to an equivalent or improved condition the natural resources within the project boundaries.

B. do not remove, cut, deface, injure or destroy trees or shrubs not affected by the work. No ropes cables or guys shall be fastened to or attached to an existing nearby trees for anchorage.

C. Obliterate all signs of temporary construction facilities such as haul roads, work areas, structures, foundation of temporary structures, stockpiles of excess or waste materials and all other vestiges of construction. Regrade, in conformance with surrounding areas temporary roads, parking and similar temporary use areas. Sod all such areas. Seeding shall include topsoil and nutrients to insure a suitable stand of grass.

D. Prevent oily or other hazardous substance from entering the ground, drainage areas or local bodies of water.

## 1.04 EROSION AND SEDIMENT CONTROL

A. Burn-off ground cover will not be permitted

B. Manage and control borrow areas to prevent sediment from entering nearby streams. Restore the area and replace topsoil. Establish permanent vegetation cover.

C. Immediately protect earthwork brought to final grade. Minimize the duration of exposure of unprotected soils.

D. Temporarily protect erodible soils by mechanical retardation and control of runoff (ie. Diversion ditches, benches, berms) or by the establishment of vegetation and mulch. Slopes too steeps for stabilization by other means shall be hydro seeding mulching anchored in place, covering by anchored metting, sodding or any combination of these to insure effective erosion control.

## 1.05 CONTROL AND DISPOSAL OF SOLID, CHEMICAL AND SANITARY WASTES

A. Wastes shall be picked up and placed in containers, which are emptied on a regular schedule.

B. Disposition of wastes shall be as follows:

1. Rubish-an debris: Remove from site and dispose in a manner that complies with federal and state requirements.

2. Garbage: If located in an area where garbage scheduled collection is available, place garbage in appropriate containers for pickup and disposal. Otherwise, transport garbage to a disposal area that complies with federal and state requirements.

3. Sanitary or Chemical: Provide chemical toilets with wastes periodically emptied in an approved stage supervised facility.

**1.06 DUST CONTROL**

A. Dust shall be kept down at all times, including non-working hours, weekends and holidays. Soil at the site, haul roads and other areas disturbed by the Contractor's operations shall be sprinkled or treated with dust suppressors as necessary to control dust. No dry brooming will be permitted. Vacuuming, wet mopping, wet sweeping or wet power brooming shall be used instead. Air blowing will be permitted only for cleaning off non-particulate debris, such as that from reinforcing bars. No sandblasting will be permitted unless the dust there from is confined. Only wet cutting of concrete blocks, concrete, and asphalt will be permitted where concrete mortar and plaster milling is done.

**1.07 NOISE CONTROL**

Noise shall be kept down at all time. Follow standard working hours schedule. Comply with the noise control requirements of the environmental quality board.

**END OF SECTION**

SECTION 01590

# Field Office and Sheds

## Part 1 - General

### 1.01. Description

A. Furnish, install and maintain temporary two (2) separate field offices for use of Contractor and PRMTA Architect/Engineer during entire construction period.

B. Field offices for use of Contractor and PRMTA Architect/Engineer shall be identified with signs and logos.

C. Furnish, install and maintain storage and works sheds needed for construction.

D. Prior to installation of offices and sheds, coordinate location, access and related facilities with PRMTA Architect/Engineer.

E. At completion of works, remove field offices, sheds and their contents.

### 1.02. Requirements

A. Construction:

1. Provide facilities that are structurally sound, watertight in like new condition and with floor raised above ground.

2. Temperature Transmission Resistance: Provide insulation compatible with occupancy and storage requirements.

3. At Contractor's option, use portable of mobile buildings.

B. Contractor's Field Office and Facilities:

1. Size: 40' x 12' Office trailer with two (2) private offices and a conference area.

2. Services:

a. Lighting: 50 foot-candles at desk top height.

b. Exterior lighting at entrance door.

c. Automatic mechanical cooling equipment to maintain comfort conditions.

d. Minimum of four (4) 110 volt duplex electric convenience outlets, at least one on each wall.
e. Electric distribution panel: Two circuits minimum, 110 volt 60 hertz service.

f. Convenient access to drinking water and toilet facilities.

g. Telephone: One direct line instrument.

h. Anchoring System for Mobile or Portable Buildings: Sufficient to withstand hurricane force winds and meeting code.

3. Meeting Area Furnishings:

a. Conference table and chairs for at least eight (8) persons.

b. Racks and files for Project Records Documents in, or adjacent to the meeting area.
c. Other Furnishing: Contractor's options.

C. PRMTA Architect/Engineer's Field Office and Facilities:

1. Size: 40' x 12' Office trailer with two (2) private offices and a conference area.

2. Provide and maintain for the duration of the project a suitable and waterproof field office for the use on the PRMTA Architect/Engineer.

3. Provide office equipment, in like new conditions, and services similar to that specified above for the Contractor's field office and, in addition, the following:

a. Telephone Service: One private line or a cellular phone line

b. Health Service: Water and sanitary facilities.

c. Janitor Service: Daily.

d. Internet Connection: Provide and install a dial up service account with access to the internet for the period of the project.

e. Computer equipment: Provide the following equipment including installation of software and set up (at the completion of the project, the equipment listed will be returned to the Contractor):
   1 ea. Desktop Computer Pentium 4 Processor, CD Rewritable, 17" monitor and the following software installed: Windows XP Pro, MS Office XP Professional and Adobe Acrobat 6.0 Pro, MS Project (latest version)
   1 ea. Photo Quality Color Inkjet Printer (printer, copier, fax & scanner).
   1 ea. Digital Camera (5 Mega pixels minimum) with 128 MB internal memory
   1 ea. Digital Camera Carrying Case

Provide paper (bond and photo quality) products, 50 CD-R package and printer inks as required.

f. Other Equipment:

1 ea. Computer Desk
2 ea. Desks 30” x 60”
3 ea. Chairs, swivel-desk
2 ea. Chairs straight-arm (visitor’s chair)
1 ea. Conference table and chairs for at least eight (8) persons
1 ea. Lateral filing cabinets, 4 drawer, legal size
2 ea. Filing trays, desk type, 5 tier, legal size
2 ea. Waste baskets
1 ea. Sharpener, pencil, electric
1 ea. Rack, wall, plan, 12 plan capacity
1 ea. Refrigerator
1 ea. Water cooler, electric
1 ea. Clock, electric
1 ea. Coffee maker/dispenser, with cups
As required: lamps, desk, shelves, windows shades and bathroom supplies.

D. Storage Sheds:

1. To meet requirements of various trades.

2. Dimensions: Adequate for storage and handling of products.

3. Ventilation: Comply with specified and code requirements for products stored.

Part 2 – Products

2.01. Materials, Equipment, Furnishings: New or used, serviceable, adequate for required purpose, and that do not violate applicable codes or regulations.

Part 3 – Execution

3.01. Installation

A. Fill and grade sites for temporary structures as necessary to provide surface drainage.

B. Construct temporary field offices and storage sheds on proper foundations, provide connections for utilities services.

1. Secure portable or mobile buildings, when used, against break-ins and hurricane force winds per code.

2. Provide steps and landings at entrance doors.

3.02. Maintenance and Cleaning

A. Provide periodic maintenance and cleaning for temporary structures, furnishings, equipment and services.

3.03. Removals

A. Remove temporary field offices, contents and services when no longer needed.

B. Remove storage sheds when no longer needed.

C. Remove foundations and debris, grade site to specified elevations and complete remaining site work indicated on Drawings.

End of Section

# SECTION 01700
# CONTRACT CLOSEOUT

## PART I GENERAL

### 1.01 CLEANING UP

A. The premises and the job site shall be maintained in a reasonable and orderly condition and kept free from accumulations of waste materials and rubbish during the entire construction period. Remove crates, cartons, and other flammable waste materials or trash from the work areas at the end of each working day.

B. Elevator shafts, electrical closets, pipe and duct shafts, chases, furred spaced and similar spaces that are generally unfinished shall be cleaned and left free from rubbish, loose plaster, mortar drippings, extraneous construction materials, dirt and dust.

C. Rubbish shall be lowered by way of chutes, taken down on hoists or lowered in receptacles. Under no circumstances shall any rubbish or waste be dropped or thrown from one level to another within or outside the building.

D. Care shall be taken by workmen not to mark, soil or otherwise, deface finished surfaces. In the event that finished surfaces become defaced, clean and restore such surfaces to their original condition.

E. Clean up immediately upon completion of each trade's work.

F. Clean areas of the building in which painting and finishing work is to be performed just prior to the start of this work and maintain these areas in satisfactory condition for painting and finishing. This cleaning includes the removal of trash and rubbish from these areas, broom cleaning of floors, and removal of any plaster, mortar, dust, and other extraneous materials from finish surfaces.

G. In addition to the cleaning specified above and the mores specific cleaning that may be required in various sections of the Specifications, the building shall be prepared for occupancy by a thorough cleaning throughout, including washing (or cleaning by other approved methods) of surfaces on which dirt or dust has collected and by washing glass on both sides. Leave equipment in an undamaged and clean condition. Re-cleaning will not be required after the work has been inspected and accepted unless later operations of the Contractors make re-cleaning of certain portions necessary.

H. Upon completion of the work, remove temporary buildings and structures, fences, scaffolding, surplus materials and rubbish of every kind from the site of the work.

**1.02 DOCUMENTS REQUIRED PRIOR TO FINAL PAYMENT**

A. Prior to final payment and before the issuance of a final Certificate for Payment in accordance with the provisions of the General Conditions, file the following papers with the Inspecting Architect:

1. The guarantee required by the General Conditions and any other extended guarantees stated in the technical sections of the Specifications.
2. Consent of surety to release of retainage or final payment as required by the General Conditions.

**1.03 OPERATION AND MAINTENCANCE MANUALS (Record and Information Booklet)**

A. Furnish three (3) complete sets of manuals containing the manufacturer's apparatus furnished under the Contract and any additional date specifically under the various sections of the Specifications.

B. Arrange the manuals in proper order, indexed and suitably bound. Certify by endorsement thereon that each of the manuals is complete and accurate. Assemble these manuals for all divisions of the work, review them for completeness and submit them to the Architect. Provide suitable transfer cases and deliver the manuals therein, indexed and marked for each division of the work.

**1.04 PROJECT RECORD DOCUMENTS**

A. As the work progresses keep a complete and accurate record of approved changes from the Contract Documents and the shop drawings indicating the work as actually installed. Changes shall be neatly and correctly shown on the respective portion of the affected document using blackline prints of the drawings affected or the Specifications with appropriate supplementary notes. This record set of "As Built Drawings", shop drawings and Specifications shall be kept at the job site for inspection by the Architect and Owner.

B. The records above shall be arranged in order, in accordance with the various sections of the Specifications and properly indexed. At the completion of the work, certify by endorsement thereof that each of the revised prints of the Drawings and Specifications is complete and accurate. Prior to applications for final payment and as a condition to its approval by the Architect and Owner, deliver the record Drawings and Specifications arranged in proper order, indexed, and endorsed as hereinbefore specified. Provide suitable

transfer cases and deliver the records therein, indexed and marked for each division of the work.

C. No review or receipt of such records by the Architect or Owner shall be a waiver of any deviation from the contract documents or the shop drawings or in any way relieve the Contractor from his responsibility to perform the work in accordance with the Contract Documents and the shop drawings to the extent they are in accordance with the Contract Documents.

**1.05 CERTIFICATE OF OCCUPANCY**

A. Obtain and pay any fees related to the Certificate of Occupancy (Permiso de Uso) and deliver to the Architect.

**END OF SECTION**

# SECTION 01710
# CLEANING

## PART I GENERAL

### 1.1 DESCRIPTION

1.1.1 Work included: Throughout the construction period, maintain the buildings and site in a standard of cleanliness as described in this Section.

1.1.2 Related work described elsewhere: In addition to standards described in this Section, comply with all requirements for cleaning up as described in various other Sections of these Specifications.

### 1.2 QUALITY ASSURANCE

1.2.1 Inspection: Conduct daily inspection, and more often if necessary, to verify that requirements of cleanliness are being met.

1.2.2 Codes and standards: In addition to the standards described in this Section, comply with all pertinent requirements of governmental agencies having jurisdiction.

## PART II PRODUCTS

### 2.1 CLEANING MATERIALS AND EQUIPMENT

Provide all required personnel, equipment, and materials needed to maintain the specified standard of cleanliness.

### 2.2 COMPATIBILITY

Use only the cleaning materials and equipment which are compatible with the surface being cleaned, as recommended by the manufacturer of the material or as approved by the Architect.

## PART III EXECUTION

### 3.1 PROGRESS CLEANING

3.1.1 General:

3.1.1.1 Retain all stored items in an orderly arrangement allowing maximum access, not impeding drainage or traffic, and providing the required protection of materials.

3.1.1.2 Do not allow the accumulation of scrap, debris, waste material, and other items not required for construction of this Work.

3.1.1.3 At least twice each month, and more often if necessary, completely remove all scrap, debris, and waste material from the job site.

3.1.1.4 Provide adequate storage for all items awaiting removal from the job site, observing all requirements for fire protection and protection of the ecology.

3.1.2 Site:

3.1.2.1 Daily and more often if necessary, inspect the site and pick up all scrap, debris, and waste material. Remove all such items to the place designated for their storage.

3.1.2.2 Weekly, and more often if necessary, inspect all arrangements of materials stored on the site; restack, tidy, or otherwise service all arrangements to meet the requirements of subparagraph 3.1.1.1 above.

3.1.2.3 Maintain the site in a neat and orderly condition at all times.

3.1.3 Structures:

3.1.3.1 Weekly, and more often if necessary, inspect the structures and pick up all scrap, debris, and waste material. Remove all such items to the place designated for their storage.

3.1.3.2 Weekly, and more often if necessary, sweep all interior spaces clean. "Clean", for the purpose of this subparagraph, shall be interpreted as meaning free from dust and other material capable of being removed by use of reasonable effort and handheld broom.

3.1.3.3 As required preparatory to installation of succeeding materials, clean the structures or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using all equipment and materials required to achieve the required cleanliness.

3.1.3.4 Following the installation of finish floor materials, clean the finish floor daily (and more often if necessary) at all times while work is being performed in the space in which finish materials have been installed. "Clean", for the purpose of this subparagraph, shall be interpreted as meaning free from all foreign material which, in the opinion of the Architect, may be injurious to the finish floor material.

## 3.2 FINAL CLEANING

3.2.1 Definition: Except as otherwise specifically provided, "clean" (for the purpose of this Article) shall be interpreted as meaning the level of cleanliness generally provided by skilled cleaners using commercial quality building maintenance equipment and materials.

3.2.2 General: Prior to completion of the Work, remove from the job site all tools, surplus materials, equipment, scrap, debris, and waste. Conduct final progress cleaning as described in Article 3.1 above.

3.2.3 Site: Unless otherwise specifically directed by the Architect, broom clean all paved areas on the site and all public paved areas directly adjacent to the site. Completely remove all resultant debris.

3.2.4 Structures:

3.2.4.1 Exterior: Visually inspect all exterior surfaces and remove all traces of soil, waste material, smudges, and other foreign matter. Remove all traces of splashed materials from adjacent surfaces. If necessary to achieve a uniform degree of exterior cleanliness, hose down the exterior of the structure. In the event of stubborn stains not removable with water, the Architect may require light sandblasting or other cleaning at no additional cost to the Owner.

3.2.4.2 Interior: Visually inspect all interior surfaces and remove all traces of soil, waste material, smudges, and other foreign matter. Remove all traces of splashed materials from adjacent surfaces. Remove all paint droppings, spots, stains, and dirt from finished surfaces. Use only the specified cleaning materials and equipment.

3.2.4.3 Glass: Clean all glass inside and outside.

3.2.4.4 Polished surfaces: To all surfaces requiring the routine application of buffed polish, apply the polish recommended by the manufacturer of the material being polished.

3.2.5 Timing: Schedule final cleaning as approved by the Architect to enable the Owner to accept a completely clean project.

## 3.3 CLEANING DURING OWNER'S OCCUPANCY

Should the Owner occupy the Work or any portion thereof prior to its completion by the Contractor and acceptance by the Owner, responsibilities for interim and final cleaning of the occupied spaces shall be as determined by the Architect in accordance with the General Conditions of the Contract.

**END OF SECTION**

# SECTION 01720
# PROJECT RECORD DOCUMENTS

## PART I GENERAL WORK INCLUDED

A. Throughout progress of the work of this Contract, maintain an accurate record of all changes in the Contract Documents, as described in this Section.

B. Upon completion of the work of this Contract, transfer the recorded changes to a set of Record Documents, as described in this Section.

## 1.02 RELATED WORK DESCRIBED ELSEWHERE

Section 01300 submittals.

## 1.03 QUALITY ASSURANCE

A. Delegate the responsibility for maintenance of Record Documents to one person on the Contractor's staff as approved in advance by the Architect.

B. Thoroughly coordinate all changes within the Record Documents, making adequate and proper entries on each page of Specifications and each sheet of drawings and other documents where such entry is required to properly show the change. Accuracy of records shall be such that future searches for items shown in the Contract Documents may reasonably rely on information obtained from the approved Record Documents.

C. Make all entries within 24 hours after receipt of information.

## 1.04 SUBMITTALS

A. The supervisory Architect's approval of the current status of Record Documents will be a prerequisite to the Architect's approval of requests for progress payment and request for final payment under the Contract.

B. Prior to submitting each request for progress payment, secure the Architect's approval of the Record Documents as currently maintained.

C. Prior to submitting request for final payment, submit the final Record Documents to the Architect and secure his approval.

## 1.05 PRODUCT HANDLING

A. Use all means necessary to maintain the job set of Record Documents completely protected from deterioration and from loss and damage until completion of the work and transfer of the recorded data to the final Record Documents. In the event of loss of recorded data, use all means necessary to secure the data to the Architect's approval; such means shall include, if necessary in the opinion of the Architect, removal and replacement of concealing materials and, in such case, all replacements shall be to the standards originally specified in the Contract Documents.

# PART II PRODUCTS

## 2.01 RECORD DOCUMENTS

A. Promptly following award of Contract, secure from the Architect one complete set of all Documents comprising the Contract. Pay the nominal fee per set as determined by the Architect.

B. At a time near the completion of the work, secure from the Architect one complete set of sepia transparencies of all drawings included in the Contract. Pay the nominal fee per set as determined by the Architect.

# PART III EXECUTION

## 3.01 MAINTENANCE OF JOB SET

A. Immediately upon receipt of the job set described above, identify each of the Documents with the title "RECORD DOCUMENTS - JOB SET"

B. Preservation:

1. Considering the Contract completion time, the probable number of occasions upon which the job set must be taken out for new entries and for examinations upon which the job set must be taken out for new entries and for examinations, and the conditions under which these activities will be performed, devise a suitable method for protecting the job set to the approval of the Architect.

2. Do not use the job set for any purpose except entry of new data and for review by the Architect, until start of transfer of data to final Record Documents.

3. Maintain the job set at the site of work as that site is designated by the Architect.

## 3.02 ENTRIES ON THE JOB SET

A. Using an erasable colored pencils (not ink or indelible pencil); clearly describe the change by note and by graphic line, as required. Date all entries. Call attention to the entry by a "cloud" around the area or areas affected. In the event of overlapping changes, different colors may be used for each of the changes.

B. Where changes are caused by directives issued by the Architect, clearly indicate the change by note in ink, colored pencil, or rubber stamp.

C. Where changes are caused by Contractor-originated proposals approved by the Architect, including inadvertent errors by the Contractor which have been accepted by the Architect, clearly indicate the change by note in erasable colored pencil.

## 3.03 CONVERSION OF SCHEMATIC LAYOUTS

A. In most cases on the drawings, arrangement of conduits and circuits, piping, ducts, and other similar items, is shown schematically and is not intended to portray precise physical layout. Final physical arrangement is as determined by the Contractor, subject to the Architect's approval. However, design of future modifications of the facility may require accurate information as to the final physical arrangement of items which are shown only schematically on the drawings.

B. Show on the job set of Record Drawings, by dimension accurate to within 25 mm (1"), the centerline of each run of items such as is described above. Clearly identify the item by accurate note such as "cast iron drain", "galv. water", etc. Show, by symbol or note, the vertical location of the item ("under slab", "in ceiling plenum", "exposed", etc."). Make all identification sufficiently descriptive that it may be related reliably to the Specifications.

C. The Architect may waive the requirements for conversion of schematic data where, in the Architect's judgment, "such conversion serves no beneficial purpose. However, do not rely upon waivers being issued except as specifically issued in writing by the Architect.

## 3.04 ACCURACY OF ENTRIES

A. Use all means necessary, including the proper tools for measurement, to determine actual locations of the installed items.

## 3.05 FINAL RECORD DOCUMENTS

A. The purpose of the final Record Documents is to provide factual information regarding all aspects of the work, both concealed and visible, to enable future modification of design to proceed without lengthy and expensive site measurement, investigation, and examination.

B. Following receipt of the sepia transparencies described above, and prior to start of transfer of recorded data thereto, secure a review by the Architect of all recorded data. Make all required revisions.

C. Carefully transfer all change data shown on the Job set of Record Drawings to the corresponding sepias, coordinating the changes as required, and clearly indicating at each affected detail and other drawing the full description of all changes made during construction and the actual location of items described above. Call attention to each entry by drawing a "cloud" around the area or areas affected. Make all change entries on the sepias neatly, consistently, and in ink or crisp black pencil.

D. Submit the completed total set of Record Documents to the Architect. Participate in review meeting or meetings as required by the Architect, make all required changes in the Record Documents, and promptly deliver the final Record Documents to the Architect.

## 3.06 CHANGES SUBSEQUENT TO ACCEPTANCE

A. The Contractor shall have no responsibility for recording changes in the work subsequent to acceptance of the work by the Owner, except for changes resulting from replacements, repairs, and alterations made by the Contractor as part of his guarantee.

**END OF SECTION**

# Division 2-Site Work

**SECTION 02070**
**SELECTIVE DEMOLITION**

## PART I GENERAL

### RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Divisions 1 Specification Sections, apply to this Section.

### SUMMARY

This Section requires the selective removal and subsequent offsite disposal of the following:

Portions of existing building indicated on drawings and as required to accommodate new construction.

Removal of doors and frames indicated "remove".

Removal and protection of existing fixtures, materials, and equipment items indicated "salvage".

### JOB CONDITIONS

Occupancy: The existing building will be occupied. Conduct selective demolition work in manner that will minimize disruption of other tenant's normal operations.

Condition of Structures: Owner assumes no responsibility for actual condition of items or structures to be demolished.

Conditions existing at time of inspection for bidding purposes will be maintained by Owner insofar as practicable. However, minor variations within structure may occur by Owner's removal and salvage operations prior to start of selective demolition work.

Partial Demolition and Removal: Items indicated to be removed but of salvageable value to Contractor may be removed from structure as work progresses. Transport salvaged items from site as they are removed.

Storage or sale removed items on site will not be permitted.

Protections: Provide temporary barricades and other forms of protection to protect Owner's personnel, and other contractor's personnel from injury due to selective demolition work.

Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities or work to remain.

Protect from damage existing finish work that is to remain in place and becomes exposed during demolition operations.

Protect floors with suitable coverings when necessary.

Provide temporary weather protection during interval between demolition and removal of existing construction on exterior surfaces and installation of new construction to ensure that no water leakage or damage occurs to structure or interior areas of existing building.

Remove protections at completion of work.

Damages: Promptly repair damages caused to adjacent facilities by demolition work.

Traffic: Conduct selective demolition operations and debris removal to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.

Do not close, block, or otherwise obstruct streets, walks, or other occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

Flame Cutting: Do not use cutting torches for removal until work area is cleared of flammable materials. At concealed spaces, such as interior of ducts and pipe spaces, verify condition of hidden space before starting flame-cutting operations. Maintain portable fire suppression devices during flame-cutting operations.

Utility Services: Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations.

Do not interrupt utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.

Maintain fire protection services during selective demolition operations.

Environmental Controls: Use temporary enclosures and other methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental protection.

Do not use water when it may create hazardous or objectionable conditions such as damage to existing property, flooding, pollution or damage to owner personnel.

**PART II PRODUCTS (Not Applicable)**

**PART III EXECUTION**

**PREPARATION**

General: Provide as necessary interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of areas to be demolished and adjacent facilities to remain.

Cease operations and notify Owner's Representative immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operations.

**DEMOLITION**

General: Perform selective demolition work in a systematic manner. Use such methods as required to complete work indicated on Drawings in accordance with demolition schedule and governing regulations.

Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain using power-driven masonry saw or hand tools: do not use power-driven impact tools.

Located demolition equipment throughout structure and promptly remove debris to avoid imposing excessive loads on supporting walls, floors, or framing.

Provide services for effective air and water pollution controls as required by local authorities having jurisdiction.

For interior slabs on grade, use removal methods that will not crack or structurally disturb adjacent slabs or partitions. Use power saw where possible.

Completely fill below-grade areas and voids resulting from demolition work. Provide fill consisting of approved earth, gravel, or sand, free of trash and debris, stones over 3 inches in diameter, roots, or other organic matter.

If unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to Owner's Representative in written, accurate detail. Pending receipt of directive from Owner's Representative, in written, accurate detail. Pending receipt of directive fro Owner's Representative, rearrange selective demolition schedule as necessary to continue overall job progress without undue delay.

## SALVAGED MATERIALS

Salvaged items: Where indicated on Drawings as "Salvage – Deliver to Owner," carefully remove indicated items, clean, store, and turn over to Owner and obtain receipt.

## DISPOSAL OF DEMOLISHED MATERIALS

Remove from building site debris, rubbish, and other materials resulting from demolition operations. Transport and legally dispose off site.

If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.

Burning of removed materials is not permitted on project site.

## CLEANUP AND REPAIR

General: Upon completion of demolition work, remove tools, equipment, and demolished materials from site. Remove protections and leave interior areas broom clean.

Repair demolition performed in excess of that required. Return elements of construction and surfaces to remain to condition existing prior to start operations. Repair adjacent construction or surfaces soiled or damaged by selective demolition work.

**END OF SECTION**

# Division 3-Concrete

# SECTION 03542 - HYDRAULIC-CEMENT-BASED UNDERLAYMENT

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. This Section includes hydraulic-cement-based underlayment for use below interior floor coverings.

B. Related Sections include the following:

1. Division 9 Sections for patching and leveling compounds applied with floor coverings.

C. Allowances: Furnish hydraulic-cement-based underlayment under the allowances specified in Division 1 Section "Allowances."

D. Unit Prices: Administrative and procedural requirements for unit prices are specified in Division 1 Section "Unit Prices."

### 1.3 SUBMITTALS

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

B. Shop Drawings: Plans indicating substrates, locations, and average depths of underlayment based on survey of substrate conditions.

C. Manufacturer Certificates: Signed by manufacturers of both underlayment and floor covering system certifying that products are compatible.

D. Qualification Data: For Installer.

E. Minutes of preinstallation conference.

### 1.4 QUALITY ASSURANCE

A. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment products required for this Project.

B. Product Compatibility: Manufacturers of both underlayment and floor covering system certify in writing that products are compatible.

C. Mockups: Apply hydraulic-cement-based underlayment mockups to demonstrate surface finish, bonding, texture, tolerances, and standard of workmanship.

1. Apply mockups approximately 100 sq. ft. (9 sq. m) in area in location indicated or, if not indicated, as directed by Architect.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

## 1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials to comply with manufacturer's written instructions to prevent deterioration from moisture or other detrimental effects.

## 1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature and humidity, ventilation, and other conditions affecting underlayment performance.

1. Place hydraulic-cement-based underlayments only when ambient temperature and temperature of substrates are between 50 and 80 deg F (10 and 27 deg C).

## 1.7 COORDINATION

A. Coordinate application of underlayment with requirements of floor covering products, including adhesives, specified in Division 9 Sections, to ensure compatibility of products.

# PART 2 - PRODUCTS

## 2.1 HYDRAULIC-CEMENT-BASED UNDERLAYMENTS

A. Underlayment: Hydraulic-cement-based, polymer-modified, self-leveling product that can be applied in minimum uniform thicknesses of 1/8 inch (3 mm) and that can be feathered at edges to match adjacent floor elevations.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Ardex; [**K-15 Self-Leveling Underlayment Concrete**] <**Insert product name or designation**>.
b. Bonsal, W. R. Company; [**Self-Leveling Underlayment**] <**Insert product name or designation**>.

c. ChemRex; [**MBT Mastertop 110 Plus Underlayment**] [**Sonneborn Sonocrete Sonoflow**] [**Thoro Underlayment, Self-Leveling**] <**Insert product name or designation**>.
d. Conspec, a Dayton Superior Company; [**Conflow**] <**Insert product name or designation**>.
e. Dayton Superior Corporation; [**LeveLayer I**] <**Insert product name or designation**>.
f. Dependable Chemical Co., Inc.; [**Skimflow ES**] <**Insert product name or designation**>.
g. L&M Construction Chemicals, Inc.; [**Levelex**] <**Insert product name or designation**>.
h. MAPEI Corporation; [**Ultraplan 1**] <**Insert product name or designation**>.
i. Maxxon Corporation; [**Level-Right**] <**Insert product name or designation**>.
j. US Mix Products Company; [**US SPEC Self - Leveling Underlayment**] <**Insert product name or designation**>.
k. <**Insert manufacturer's name; product name or designation.**>

3. Cement Binder: ASTM C 150, portland cement, or hydraulic or blended hydraulic cement as defined by ASTM C 219.
4. Compressive Strength: Not less than [**4100 psi (28 MPa)**] <**Insert value**> at 28 days when tested according to ASTM C 109/C 109M.
5. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer formulated for use with underlayment when applied to substrate and conditions indicated.

B. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3 to 6 mm); or coarse sand as recommended by underlayment manufacturer.

1. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.

C. Water: Potable and at a temperature of not more than 70 deg F (21 deg C).

D. Reinforcement: For underlayment applied to wood substrates, provide galvanized metal lath or other corrosion-resistant reinforcement recommended in writing by underlayment manufacturer.

E. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.

F. Corrosion-Resistant Coating: Recommended in writing by underlayment manufacturer for metal substrates.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates, with Installer present, for conditions affecting performance.

1. Proceed with application only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. General: Prepare and clean substrate according to manufacturer's written instructions.

1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
2. Fill substrate voids to prevent underlayment from leaking.

B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.

1. Moisture Testing: Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates do not exceed a maximum moisture-vapor-emission rate of [**3 lb of water/1000 sq. ft. (1.36 kg of water/100 sq. m)**] <**Insert emission**> in 24 hours.

C. Wood Substrates: Mechanically fasten loose boards and panels to eliminate substrate movement and squeaks. Sand to remove coatings that might impair underlayment bond and remove sanding dust.

1. Install underlayment reinforcement recommended in writing by manufacturer.

D. Metal Substrates: Mechanically remove, according to manufacturer's written instructions, rust, foreign matter, and other contaminants that might impair underlayment bond. Apply corrosion-resistant coating compatible with underlayment if recommended in writing by underlayment manufacturer.

E. Nonporous Substrates: For ceramic tile, quarry tile, and terrazzo substrates, remove waxes, sealants, and other contaminants that might impair underlayment bond, and prepare surfaces according to manufacturer's written instructions.

F. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.

## 3.3 APPLICATION

A. General: Mix and apply underlayment components according to manufacturer's written instructions.

1. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.
2. Coordinate application of components to provide optimum underlayment-to-substrate and intercoat adhesion.
3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.

B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.

C. Apply underlayment to produce uniform, level surface.

1. Apply a final layer without aggregate to produce surface.
2. Feather edges to match adjacent floor elevations.

D. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.

E. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.

F. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

## 3.4 PROTECTION

A. Protect underlayment from concentrated and rolling loads for remainder of construction period.

END OF SECTION 03542

SECTION 03600 - GROUT

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope:
1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified and required to furnish and install grout.
2. Grout shall be placed at the following locations:
a. Column and beam bearing.
b. Equipment bases.
c. Handrails and railings.
d. Construction joints.
e. Intrusion grouting.
3. The types of grout include the following:
a. Non-shrink, epoxy type.
b. Non-shrink, non-metallic type.
c. Ordinary cement-sand.

B. Classes of Ordinary Cement Type Grout:
1. Class "A" ordinary cement type grout shall have a compression strength of 4000 PSI and include the following:
a. Foundation grout.
b. Construction joint grout.

C. Related Sections:
1. Section 03251, Expansion Joints
2. Section 03300, Cast-In-Place Concrete
3. Section 04100, Mortar
4. Section 05120, Structural Steel

1.02 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
1. ASTM C 144, Standard Specification for Aggregate for Masonry Mortar.
2. ASTM C 150, Standard Specification for Portland Cement.
3. CRD-C-619, Specification for Grout Fluidifier.
4. CRD-C-621, Specification for Non-Shrink Grout.

1.03 SUBMITTALS

A. Shop Drawings: Submit for approval the following:
1. Manufacturer's specifications and installation instructions for all proprietary materials.
2. For ordinary cement grout, copies of grout design mix and laboratory test reports for grout strength tests.

B. Reports and Certificates:
1. For proprietary materials, submit copies of reports on quality control tests.
2. Submit certification that materials meet specification requirements for nonproprietary materials.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials: Grout materials from manufacturers shall be delivered in unopened containers and shall bear intact manufacturer's labels.

B. Storage of Materials: Grout materials shall be stored in a dry shelter and shall be protected from moisture.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Non-shrink, Nonmetallic Grout:
1. Prepackaged non-staining cementious grout which shall meet the minimum requirements of CRD C-621 and requiring only the addition of water at the jobsite.
2. Product and Manufacturer: Provide one of the following:
a. Euco N-S, as manufactured by The Euclid Chemical Company.
b. Masterflow 928, as manufactured by Master Builders, Incorporated.
c. Sika Grout 212, as manufactured by Sika Corporation.
d. Or equal.

PART 3 - EXECUTION

3.01 INSPECTION

A. CONTRACTOR and his installer shall examine the substrate and conditions under which grout is to be placed, and notify ENGINEER in writing of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.02 INSTALLATION

A. General:
1. Place grout as shown and in accordance with manufacturer's instructions. If manufacturer's instructions conflict with the Specifications do not proceed until ENGINEER provides clarification.
2. Drypacking will not be permitted.
3. Manufacturers of proprietary products shall make available upon 72 hours notification the services of a qualified, full time employee to aid in assuring proper use of the product under job conditions.
4. Placing grout shall conform to temperature and weather limitations in Section 03300.

B. Columns, Beams and Equipment Bases:
After shimming columns, beams and equipment to proper grade, securely tighten anchor bolts. Properly form around the base plates allowing sufficient room around the edges for placing the grout. Adequate depth between the bottom of the base plate and the top of concrete base must be provided to assure that the void is completely filled with the non-shrink, non-metallic grout.

C. Construction Joints:
Place a 2-inch thick coat of ordinary cement grout over the contact surface of the old concrete at the interface of horizontal construction joints as outlined in Section 03251 and Section 03300 of these Specifications.

END OF SECTION

SECTION 03900
CONCRETE RESTORATION AND CLEANING

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Furnishing of all labor, material, equipment, supervision, and incidentals as necessary to perform the restoration to the concrete surfaces as shown on the Drawings and specified herein. The concrete repair shall include:

1. Repair of cracked and deteriorated concrete coating.

2. Repair of concrete foundation cracks.

3. Apply coating to concrete foundation.

B. Location

1. The Contractor shall carefully review the accompanying set of Drawings for specific location delineation of each type of repair. Although attempts were made to delineate all repair areas on the Drawings, additional repair areas may be identified in the field.

2. The Contractor shall be responsible for extent and identifying the exact location of all necessary repairs.

### 1.02 QUALITY ASSURANCE

A. Qualification of Manufacturer

Products used in the work of this section shall be produced by manufacturers regularly engaged in manufacturer of similar items and with a history of successful production acceptable to the Architect/Engineer.

B. Qualification of workmen

1. Use skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with he specified requirements and methods needed for proper performance of the work.

2. In acceptance or rejection of the work, the Architect/Engineer will make no allowance for lack of skill on the part of the workmen.

C. Architect/Engineer Observations

1. The Architect/Engineer intends to review prepared areas for suitable preparation prior to installing any patch material. The Contractor shall, therefore, coordinate his patching efforts with the Architect/Engineer.

2. Areas not meeting the Architect/Engineer's satisfactory review shall be further prepared.

SECTION 03900
CONCRETE RESTORATION AND CLEANING

1.03 SUBMITTALS

A. Submit Product Data Under Provisions of Division 01.

1. Epoxy materials

2. Polymer mortar

3. Liquid bonding and admixture agents.

4. Joint sealant

5. Concrete Coating

1.04 DELIVERY, STORAGE AND HANDLING

A. All materials shall be delivered to the job site and stored in the manufacturer's sealed, undamaged containers. Each container shall be identified with material name, date of manufacture, and lot number. Storage shall be as recommended by the manufacturer for preventing damage.

1.05 PROJECT CONDITIONS

A. Environmental Conditions

The Contractor shall install the materials only when all of the following criteria can be met, or as otherwise recommended by the product manufacturer:

1. Surface receiving material shall be dry or damp (epoxy application).

2. Substrate surface temperature is above 50°F and lower than 110°F during and seven days after completion of work.

B. Safety Requirements

1. Open fires and spark producing equipment shall not be in the application area until vapors have dissipated.

2. Post No Smoking signs in area during and for at least eight hours following application period.

3. Strictly adhere to special requirements of manufacturer as modified by applicable rules and regulations of local, state, and Federal authorities having jurisdiction.

SECTION 03900
CONCRETE RESTORATION AND CLEANING

PART 2 PRODUCTS

2.01 MATERIALS

A. Cement:

1. All cement used in the patching mixtures shall meet the requirements of ASTM C150, Type I.

B. Aggregates:

1. Aggregates used in the concrete and shotcrete mixtures shall be clean sharp concrete mix (3/8 in. maximum aggregate) sand with no dust and shall meet the requirements of ASTM C33.

2. The source of the aggregate shall be subject to the approval of the Architect/Engineer.

C. Admixtures:

1. Water Reducing Admixture shall conform to the requirements of ASTM C494 and shall be used strictly in accordance with the manufacturer's recommendations.

D. Epoxy Materials: All epoxy materials used on the job shall be 100% solid, two-component, moisture-insensitive materials as manufactured by the Sika Chemical Corporation, Protex Industries, or approved equivalent. The following products or approved substitutions shall be used:

1. Sonobond by Sonneborn

2. SIKA DUR 32, Hi-Mod by SIKA

E. Manufactured Polymer-Modified Mortar: Shall be pre-manufactured, cementitious repair compounds. The following or approved substitutes shall be used:

1. Sonopatch by Sonneborn

2. Sikatop 122 Repair Mortar by SIKA

F. Liquid bonding agents and admixtures shall be acrylic latex or polymer. The following or approved substitutes shall be used:

1. Sonocrete by Sonneborn

2. Acryl 60 by Thoro

3. Acrylic Admix 101 by Larsen

G. Joint Sealant: One part polyurethane sealants, Sonolastic NP 1 by Sonneborn, SIKAFLEX-1a by SIKA, or approved substitute.

H. Accessories

1. Reinforcing bars shall conform to ASTM 615, grade 60 and be epoxy coated.

2. Welded wire fabrics shall conform to ASTM A185, be galvanized and be size 2x2 - WO.9 x WO.9 unless noted otherwise on the Drawings.

3. Expansion Anchors shall be Wej-It or approved equivalent. Anchors shall have equivalent or greater pullout and shear values as Wej-It. Anchor, washers, and nuts shall be hot-dipped galvanized.

4. Metal primer shall be as recommended by the elastomeric coating manufacturer for use as a primer to coating application.

2.02 PATCHING MATERIALS

A. General

1. Shallow spalls (3/4 in. average or less) shall be repaired by either of the following material:

a. Manufactured Polymer Modified Mortar.

b. Concrete mixture with liquid bonding and admixture agent. Mix agent at 2:1 ratio with water or as recommended by the material supplier.

2. Deep spalls (greater than 3/4 in. average depth) shall be repaired by either of the following methods:

a. Concrete mixtures bonded with epoxy resins.

b. Shotcrete bonded with slurry coat.

B. Polymer Mortar

1. Mix dry component to liquid component per manufacturer's recommendations.

C. Concrete Mixture

1. Compressive strength - 4,000 psi (28 day minimum).

2. Aggregates - 3/8 maximum size, well graded from coarse to fine passing 100 through a 3/8 sieve.

3. Slump - Two to three inches.

SECTION 03900
CONCRETE RESTORATION AND CLEANING

2.03 EQUIPMENT

A. General

It is the Contractor's responsibility to determine and use the equipment necessary for performing the work covered by this section.

PART 3 EXECUTION

3.01 TYPICAL SPALLED AND DAMAGED CONCRETE REPAIR PROCEDURE

A. General: The procedure given below is general and may vary slightly for each individual repair. Refer to the details for the procedural steps for individual repair items.

B. Removal

1. The exact locations of the spall and damaged concrete repairs will be determined in the field by the Contractor and reviewed by the Architect/Engineer at the time of construction.

2. For top surfaces of slabs, the Contractor will outline the area of spalled concrete to be removed by making a 1-in. deep sawcut around the perimeter of the spalled area. Corners of cuts shall be approximately 90 degree angles.

3. All loose and unsound concrete shall be removed with pneumatic jack hammers.

4. If sound concrete is reached before exposing more than 50% of the reinforcing steel, the removal shall be continued to a depth that will allow 3/4 of the reinforcing steel to be exposed.

5. If rusting of the reinforcing steel is evident, removal shall continue until the entire bar(s) has a clear distance exposure of 3/4-in. all around or as required to permit proper cleaning of the reinforcing.

C. Surface Preparation

1. All rusted reinforcement and rust stained concrete shall be sandblasted to shiny metal and clean concrete respectively.

2. The cavity shall then be blown clean with compressed air to assure that all loose particles have been removed.

3. Immediately coat exposed reinforcing with epoxy rebar coating materials.

4. Reinforcing bars which have lost more than 30% of their area due to corrosion shall be lap spliced with new reinforcement of the same size as the original bar. New reinforcement shall lap at least 30 bar diameters into good existing reinforcement.

5. Install new reinforcing bars and/or welded wire fabric in accordance with procedures given on the Drawings for each repair item. Allow rebar coating to become tack free prior to placing patch material.

6. The prepared cavity shall be inspected and approved by the Architect/Engineer prior to placing any bonding agent or patch material. Allow rebar coating to become tack free prior to placing patch material.

D. Installation

1. Polymer Mortar

   a. Use the liquid component as a priming material applied directly to the prepared concrete substrate. Apply at a rate recommended by the manufacturer.

   b. Immediately fill the void with polymer mortar specified above and compact into place.

2. Concrete Mixture With Liquid Bonding Agents

   a. Mix agent with mix water in a ratio as recommended by agent supplier.

   b. Apply bonding agent or scrub coat as recommended by agent supplier to prepared surface.

   c. Fill the void with concrete mixture and compact into place.

3. Concrete Mixture Bonded with Epoxy

   a. The approved cavity shall be coated evenly and completely with the epoxy bonding material. The amount of application shall be as recommended by the manufacturer of the epoxy.

   b. A concrete mixture as specified above shall immediately be worked into the cavity and adequately compacted to assure that no voids remain in the patch.

E. Finish

1. The surface shall be leveled to true, straight lines with screed or wood float.

2. The surface finish shall be brushed and/or sponged as required to match the texture of existing adjacent surfaces as close as possible.

3. Strike lines are located on the existing surface in an approximate 1 ft. x 3 ft. pattern. New lines shall be continued throughout the new patches and where required to match existing.

3.02 RANDOM CRACK AND CONSTRUCTION JOINT REPAIR PROCEDURE

A. Preparation

1. Route all random cracks to a depth of 1/2 in. and width of 1/2 inch. Remove sealant from construction joints with appropriate tools. Refer to detail on Plans.

2. Sandblast the routed crack or joint and 6 in. on each side of the crack or joint if this has not been previously accomplished under other sections.

3. Blow clean with compressed air.

4. If concrete deterioration exceeds the dimensions indicated above, remove all unsound concrete and rebuild the joints or cracks to the dimensions indicated above utilizing the spall repair procedures above.

B. Installation

1. Fill all cracks and joints with sealant in a manner recommended by the manufacturer of the sealant used on the job. Use a primer material prior to installing the sealant if recommended by the manufacturer of the sealant.

END OF SECTION 03900

SECTION 03930 - CONCRETE REHABILITATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Removal of deteriorated concrete and reinforcement and subsequent replacement and patching.
2. Floor joint repair.
3. Epoxy crack injection.
4. Corrosion-inhibiting treatment.
5. Polymer overlays.
6. Polymer sealers.
7. Steel structural reinforcement.
8. Composite structural reinforcement.

B. Related Sections include the following:

1. Division 7 Section "Water Repellents" for clear penetrating and film-forming water repellents applied to concrete.

1.3 UNIT PRICES

A. Unit prices include the cost of preparing existing construction to receive the work indicated[ **and costs of field quality-control testing required by the Work for which the unit price applies**].

B. Concrete Removal and Replacement or Patching: Work will be paid for by the cubic foot (cubic meter) computed on the basis of rectangular solid shapes approximating the actual shape of concrete removed and replaced with average depths, widths, and lengths, measured to the nearest inch (centimeter).

1. Reinforcing bar replacement will be paid for separately by the pound (kilogram) of replacement steel with welded and mechanical splices paid for by the unit.

C. Epoxy Crack Injection: Work will be paid for by the linear foot (linear meter) of crack injected.

D. Polymer Overlays: Work will be paid for by the square foot (square meter) of exposed overlay surface.

E. Composite Structural Reinforcement: Work will be paid for by the square foot (square meter) of composite material applied.

## 1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include material descriptions, chemical composition, physical properties, test data, and mixing, preparation, and application instructions.

B. [**Formwork**] [**and**] [**Shoring**] Drawings: Prepared by or under the supervision of a qualified professional engineer detailing [**formwork**] [**and**] [**temporary shoring and supports**]. Include schedule and sequence for erection and removal relative to removal of deteriorated concrete and reinforcement and subsequent repair and reinforcement.

C. Samples: Cured Samples of [**overlay**] [**and**] [**patching**] materials.

D. Qualification Data: For [**installers**] [**professional engineer**] [**manufacturers**] [**and**] [**testing agency**].

1. For products required to be installed by workers approved by product manufacturers, include letters of acceptance by product manufacturers certifying that installers are approved to apply their products.

E. Material Certificates: For each type of product indicated, signed by manufacturers.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for [**bonding agents**] [**patching mortars**] [**epoxy adhesives**] [**and**] [**composite structural reinforcement**].

G. Rehabilitation Program: For each phase of rehabilitation process, including protection of surrounding materials and Project site during operations. Describe in detail materials, methods, equipment, and sequence of operations to be used for each phase of the Work.

1. If alternative materials and methods to those indicated are proposed for any phase of rehabilitation work, submit substitution request complying with Division 1 Section "Product Requirements" and provide a written description of proposed materials and methods, including evidence of successful use on other comparable projects, and a testing program to demonstrate their effectiveness for this Project.

## 1.5 QUALITY ASSURANCE

A. Installer Qualifications: Installer that employs workers trained and approved by manufacturer to apply [**corrosion-inhibiting treatments**] [**concrete patching and rebuilding materials**] [**epoxy crack injection materials**] [**polymer overlays**] [**polymer sealers**] [**and**] [**composite structural reinforcement**].

B. Manufacturer Qualifications: Manufacturer that employs factory-trained representatives who are available for consultation and Project-site inspection.

C. Source Limitations: Obtain [**concrete patching and rebuilding materials**] [**epoxy crack injection materials**] [**and**] [**composite structural reinforcement materials**][**, each,**] through one source from a single manufacturer.

D. Mockups: Build mockups for [**concrete removal and patching**] [**floor joint repair**] [**epoxy crack injection**] [**polymer overlays**] [**polymer sealers**] [**and**] [**composite structural reinforcement**] to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's original and unopened containers, labeled with type and name of products and manufacturers.

B. Comply with manufacturer's written instructions for minimum and maximum temperature requirements and other conditions for storage.

C. Store cementitious materials off the ground, under cover, and in a dry location.

D. Store aggregates, covered and in a dry location, where grading and other required characteristics can be maintained and contamination avoided.

## 1.7 PROJECT CONDITIONS

A. Environmental Limitations for Epoxies: Do not apply when air and substrate temperatures are outside limits permitted by manufacturer. During hot weather, cool epoxy components before mixing, store mixed products in shade, and cool unused mixed products to retard setting. Do not apply to wet substrates unless approved by manufacturer.

1. Use only Class A epoxies when substrate temperatures are below or are expected to go below 40 deg F (5 deg C) within 8 hours.
2. Use only Class A or B epoxies when substrate temperatures are below or are expected to go below 60 deg F (16 deg C) within 8 hours.
3. Use only Class C epoxies when substrate temperatures are above and are expected to stay above 60 deg F (16 deg C) for 8 hours.

B. Cold-Weather Requirements for Cementitious Materials: Do not apply unless air temperature is above 40 deg F (5 deg C) and will remain so for at least 48 hours after completion of Work.

C. Cold-Weather Requirements for Cementitious Materials: Comply with the following procedures:

1. When air temperature is below 40 deg F (5 deg C), heat patching material ingredients and existing concrete to produce temperatures between 40 and 90 deg F (5 and 32 deg C).

2. When mean daily air temperature is between 25 and 40 deg F (minus 4 and plus 5 deg C), cover completed Work with weather-resistant insulating blankets for 48 hours after repair or provide enclosure and heat to maintain temperatures above 32 deg F (0 deg C) within the enclosure for 48 hours after repair.
3. When mean daily air temperature is below 25 deg F (minus 4 deg C), provide enclosure and heat to maintain temperatures above 32 deg F (0 deg C) within the enclosure for 48 hours after repair.

D. Hot-Weather Requirements for Cementitious Materials: Protect repair work when temperature and humidity conditions produce excessive evaporation of water from patching materials. Provide artificial shade and wind breaks, and use cooled materials as required. Do not apply to substrates with temperatures of 90 deg F (32 deg C) and above.

E. Environmental Limitations for High-Molecular-Weight Methacrylate Sealers: Do not apply when concrete surface temperature is below 55 deg F (13 deg C) or above [**75 deg F (24 deg C)**] [**90 deg F (32 deg C)**]. Apply only to [**dry substrates**] [**substrates that have been dry for at least 72 hours**].

## PART 2 - PRODUCTS

### 2.1 BONDING AGENTS

A. Epoxy-Modified, Cementitious Bonding and Anticorrosion Agent: Product that consists of water-insensitive epoxy adhesive, portland cement, and water-based solution of corrosion-inhibiting chemicals that forms a protective film on steel reinforcement.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Euclid Chemical Company (The); Corr-Bond.
    b. Kaufman Products, Inc; Surepoxy HM EPL.
    c. Sika Corporation; Armatec 110 EpoCem.
    d. Sonneborn, Div. of ChemRex; Sonoprep.
    e. Sto Corp., Concrete Restoration Division; Sto Bonding and Anti-Corrosion Agent.
    f. Tamms Industries, Inc.; Duralprep A.C.
    g. <**Insert manufacturer's name; product name or designation.**>

B. Epoxy Bonding Agent: ASTM C 881/C 881M, Type [**II**] [**V**].

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

    a. Anti-Hydro International, Inc.; Poly-Epoxy Bonding #100.
    b. ChemCo Systems; CCS Bonder Liquid, [**LWL**] [**or**] [**SWL**].
    c. Dayton Superior Corporation; [**Resi-Bond (J-58)**] [**Sure-Anchor Epoxy (J-50),**] [**or**] [**Sure-Inject (J-56)**].

d. Euclid Chemical Company (The); [**Euco #352 Epoxy System**] [**Euco #452 Epoxy System**] [**or**] [**Euco #620 Epoxy System**].
e. Kaufman Products, Inc.; SurePoxy HM EPL.
f. MBT Protection and Repair, Div. of ChemRex; Concresive Liquid LPL.
g. Meadows, W. R., Inc.; [**Sealtight Rezi-Weld 1000**] [**Sealtight Rezi-Weld Gel Paste**] [**Sealtight Rezi-Weld Gel Paste State**] [**or**] [**Sealtight Rezi-Weld LV**].
h. Sika Corporation; [**Sikadur 31, Hi-Mod Gel**] [**Sikadur 32, Hi-Mod**] [**Sikadur 32, Hi-Mod LPL**] [**Sikadur 35, Hi-Mod LV**] [**or**] [**Sikadur 35, Hi-Mod LV LPL**].
i. Sonneborn, Div. of ChemRex; [**Epogel**] [**or**] [**Epogrip**].
j. Tamms Industries, Inc.; Duralbond.
k. ThoRoc, Div. of ChemRex; Epoxy Adhesive 24LPL.
l. Unitex; [**Pro-Poxy 204**] [**or**] [**Slow Set Bonding Agent**].
m. US MIX Products Company; [**US Spec Maxi - Bond 2500**] [**or**] [**US Spec Slow Bond 6500**].
n. <**Insert manufacturer's name; product name or designation.**>

3. Thin Film Open Time: Not less than [**two**] [**six**] [**24**] hours.

C. Latex Bonding Agent: ASTM C 1059, Type [**I**] [**II**] [**II at exterior locations and where indicated, Type I at other locations**].

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Latex Bonding Agent, Type I:

1) Euclid Chemical Company (The); Euco Weld.
2) Kaufman Products, Inc.; Sureweld.
3) Meadows, W. R. Inc.; Intralok.
4) Sika Corporation; Sikalatex.
5) US MIX Products Company; US Spec Bondcoat.
6) <**Insert manufacturer's name; product name or designation.**>

b. Latex Bonding Agent, Type II:

1) Dayton Superior Corporation; Day-Chem Ad Bond (J-40).
2) Euclid Chemical Company (The); Flex-Con.
3) Kaufman Products, Inc.; Surebond.
4) Meadows, W. R. Inc.; Sealtight Acry-Lok.
5) Sonneborn, Div. of ChemRex; Acrylic Additive.
6) US MIX Products Company; US Spec Acrylcoat.
7) <**Insert manufacturer's name; product name or designation.**>

D. Mortar Scrub-Coat: 1 part portland cement complying with ASTM C 150, Type I, II, or III and 1 part fine aggregate complying with ASTM C 144, except 100 percent passing a No. 16 (1.18-mm) sieve.

2.2 PATCHING MORTAR

A. Patching Mortar, General:

1. Unless otherwise indicated, use any of the products specified in this Article.
2. Overhead Patching Mortar: For overhead repairs, use patching mortar recommended by manufacturer for overhead use and as specified in this Article.
3. Coarse Aggregate for Adding to Patching Mortar: Washed aggregate complying with ASTM C 33, Size No. 8, Class 5S. Add only as permitted by patching mortar manufacturer.

B. Job-Mixed Patching Mortar: 1 part portland cement complying with ASTM C 150, Type I, II, or III and 2-1/2 parts fine aggregate complying with ASTM C 144, except 100 percent passing a No. 16 (1.18-mm) sieve.

C. Cementitious Patching Mortar: Packaged, dry mix complying with ASTM C 928.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cementitious Patching Mortar:

1) Kaufman Products, Inc.; Hicap.
2) MBT Protection and Repair, Div. of ChemRex; [**Emaco S66 CI**] [**Emaco S77 CI**] [**or**] [**Emaco S88 CI**].
3) Sika Corporation; [**Sikarepair 223**] [**or**] [**Sikarepair SHB**].
4) Sonneborn, Div. of ChemRex; Deep Pour Mortar.
5) Sto Corp., Concrete Restoration Division; Sto Full-Depth Repair Mortar.
6) ThoRoc, Div. of ChemRex; LA Repair Mortar.
7) <**Insert manufacturer's name; product name or designation.**>

b. Cementitious Patching Mortar, Rapid Setting:

1) CGM, Incorporated; Pro Patching Cement.
2) Dayton Superior Corporation; [**Day-Chem Perma-Patch**] [**Re-Crete 5 Minute**] [**or**] [**Re-Crete 20 Minute**].
3) Euclid Chemical Company (The); Euco-Speed.
4) Fox Industries, Inc.; FX-928 Rapid Hardening Mortar.
5) Kaufman Products, Inc.; Duracrete.
6) Meadows, W. R. Inc.; [**Sealtight Meadow-Patch 5**] [**Sealtight Meadow-Patch 20**] [**or**] [**Sealtight Futura-15**].
7) Sika Corporation; Sikaset Roadway Patch.
8) Sonneborn, Div. of ChemRex; Road Patch.
9) Sto Corp., Concrete Restoration Division; Sto Rapid Repair Mortar.
10) Tamms Industries, Inc.; Speed Crete 2028.
11) ThoRoc, Div. of ChemRex; [**10-60 Rapid Mortar**] [**or**] [**10-61 Rapid Mortar**].
12) Unitex; Patch Set 928.
13) US MIX Products Company; US Spec Transpatch.
14) Watson Bowman Acme Corp., Degussa AG; Wabo Renew 100.

15) <**Insert manufacturer's name; product name or designation.**>

D. Polymer-Modified, Cementitious Patching Mortar: Packaged, dry mix complying with ASTM C 928, that contains a[ **non-redispersible**] latex additive as either a dry powder or a separate liquid that is added during mixing.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. AQUAFIN, Inc.; MORTAR-40.
b. CGM, Incorporated; [**Pro Trowel Mortar.**] [**Pro Gel Mortar.**] [**Pro Flowable Mortar.**] [**Pro N.B.P.**]
c. Dayton Superior Corporation; [**HD-50**] [**or**] [**Thin Resurfacer**].
d. Euclid Chemical Company (The); [**Concrete Coat**] [**Thin Coat**] [**or**] [**Verticoat**].
e. Fox Industries, Inc.; [**FX-243**] [**or**] [**FX-273**] Trowel Grade Polymer Repair Mortar.
f. Kaufman Products, Inc.; [**Patchwell**] [**Patchwell Kit**] [**Patchwell Kit D**] [**or**] [**Patchwell Kit HB**].
g. MBT Protection and Repair, Div. of ChemRex; [**Emaco R320 CI**] [**or**] [**Emaco R350 CI**].
h. Meadows, W. R., Inc.; [**Sealtight Meadow-Patch T1**] [**or**] [**Sealtight Meadow-Crete FNP**].
i. Sika Corporation; [**SikaTop 121 Plus**] [**SikaTop 122 Plus**] [**SikaTop 123 Plus**] [**or**] [**SikaTop 126 Plus**].
j. Sonneborn, Div. of ChemRex; [**Screed**] [**Sonopatch 100**] [**Sonopatch 200**] [**Sonopatch 300**].
k. Sto Corp., Concrete Restoration Division; [**Sto Flowable Mortar**] [**Sto Overhead Mortar**] [**Sto Thin-Coat Mortar**] [**or**] [**Sto Trowel-Grade Mortar**].
l. Tamms Industries, Inc.; [**Duraltop Fast Set**] [**or**] [**Speed Crete PM**].
m. ThorRoc, Div. of ChemRex, Inc.; [**HB2 Repair Mortar**] [**or**] [**Polyset**].
n. US MIX Products Company; [**US Spec Polypatch FR**] [**or**] [**US Spec Thinpatch**].
o. <**Insert manufacturer's name; product name or designation.**>

E. Polymer-Modified, Silica-Fume-Enhanced, Cementitious Patching Mortar: Packaged, dry mix complying with ASTM C 928, that contains silica fume complying with ASTM C 1240 and a [**non-redispersible** ]latex additive as either a dry powder or a separate liquid that is added during mixing.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Euclid Chemical Company (The); Verticoat Supreme.
b. Fox Industries, Inc.; [**FX-261 Polymer Repair Mortar**] [**or**] [**FX-286**].
c. MBT Protection and Repair, Div. of ChemRex; Emaco S88 CI.
d. Meadows, W. R., Inc.; [**Sealtight Meadow-Crete H2**] [**or**] [**Sealtight Meadow-Crete-GPS**].
e. Sika Corporation; Sika Monotop 615.

f. Sonneborn, Div. of ChemRex; [**Gel Patch**] [**Sonopatch 200**] [**or**] [**Sonopatch 300**].
g. US Mix Products Company; US Spec V/O Patch.
h. <**Insert manufacturer's name; product name or designation.**>

## 2.3 CONCRETE

A. Concrete Materials and Admixtures: Comply with Division 3 Section "[**Cast-in-Place Concrete**] [**Cast-in-Place Concrete (Limited Applications)**]."

B. Steel and Fiber Reinforcement and Reinforcement Accessories: Comply with Division 3 Section "[**Cast-in-Place Concrete**] [**Cast-in-Place Concrete (Limited Applications)**]."

C. Form-Facing Materials: Comply with Division 3 Section "[**Cast-in-Place Concrete**] [**Cast-in-Place Concrete (Limited Applications)**]."

D. Shotcrete: Comply with Division 3 Section "Shotcrete."

E. Preplaced Aggregate: Washed aggregate complying with ASTM C 33, Class 5S, with [**95 to 100 percent passing a 1-1/2-inch (37.5-mm) sieve, 40 to 80 percent passing a 1-inch (25-mm) sieve, 20 to 45 percent passing a 3/4-inch (19-mm) sieve, 0 to 10 percent passing a 1/2-inch (12.5-mm) sieve, and 0 to 2 percent passing a 3/8-inch ((9.5-mm)) sieve**] [**100 percent passing a 1-1/2-inch (37.5-mm) sieve, 95 to 100 percent passing a 1-inch (25-mm) sieve, 40 to 80 percent passing a 3/4-inch (19-mm) sieve, 0 to 15 percent passing a 1/2-inch (12.5-mm) sieve, and 0 to 2 percent passing a 3/8-inch (9.5-mm) sieve**].

F. Fine Aggregate for Grout Used with Preplaced Aggregate: Fine aggregate complying with ASTM C 33, but with 100 percent passing a No. 8 (2.36-mm) sieve, 95 to 100 percent passing a No. 16 (1.18-mm) sieve, 55 to 80 percent passing a No. 30 (0.6-mm) sieve, 30 to 55 percent passing a No. 50 (0.3-mm) sieve, 10 to 30 percent passing a No. 100 (0.15-mm) sieve, 0 to 10 percent passing a No. 200 (0.075-mm) sieve, and having a fineness modulus of 1.30 to 2.10.

G. Grout Fluidifier for Grout Used with Preplaced Aggregate: ASTM C 937.

H. Portland Cement for Grout Used with Preplaced Aggregate: ASTM C 150.

I. Pozzolans for Grout Used with Preplaced Aggregate: ASTM C 618.

## 2.4 MISCELLANEOUS MATERIALS

A. Epoxy Joint Filler: 2-component, semirigid, 100 percent solids, epoxy resin with a Type A Shore durometer hardness of at least 80 per ASTM D 2240.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Anti-Hydro International, Inc.; Groove & Crack Filler #250.
b. ChemCo Systems; CCS Grout, [**Control Joint**] [**or**] [**Control Joint - HB**].
c. Euclid Chemical Company (The); Euco [**700**] [**or**] [**800**].

d. Kaufman Products, Inc.; Surepoxy Flexijoint.
e. MBT Protection and Repair, Div. of ChemRex; Masterfill 300i.
f. Meadows, W. R., Inc.; Sealtight Rezi-Weld Flex.
g. Metzger/McGuire; [**MM-80**] [**or**] [**Edge-Pro XL**].
h. Sika Corporation; [**Sikadur 51 NS**] [**or**] [**Sikadur 51 SL**].
i. Unitex; [**Pro-Flex**] [**or**] [**Pro-Flex Gel**].
j. US Mix Products Company; US Spec SR 50 - EJF.
k. <**Insert manufacturer's name; product name or designation.**>

B. Polyurea Joint Filler: 2-component, semirigid, 100 percent solids, polyurea resin with a Type A Shore durometer hardness of at least 80 per ASTM D 2240.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. ASTC Polymers; Penetron 3003.
b. ChemCo Systems; CCS Grout, Polyurea [**Control Joint**] [**or**] [**SWL**].
c. Dayton Superior Corporation; Joint Saver II.
d. Euclid Chemical Company (The); Euco Qwikjoint 200.
e. MBT Protection and Repair, Div. of ChemRex; Masterfill 400 CT.
f. Metzger/McGuire; [**Spal-Pro RS 88**] [**or**] [**Spal-Pro 2000**].
g. Sonneborn, Div. of ChemRex; Sonolastic TF-100.
h. <**Insert manufacturer's name; product name or designation.**>

C. Epoxy Crack Injection Adhesive: ASTM C 881/C 881M, Type [**I,**] [**IV,**] [**Grade 1,**] [**except for gel time,**] [**solvent free**].

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. ChemCo Systems; CCS Grout, [**Standard**] [**Standard - High Ambient Temperature**] [**or**] [**Low Viscosity**].
b. Dayton Superior Corporation; [**Resi-Bond (J-58)**] [**Sure-Anchor Epoxy (J-50)**] [**or**] [**Sure-Inject (J-56)**].
c. Euclid Chemical Company (The); [**Euco #352 Epoxy System**] [**Euco #452 Epoxy System**] [**Euco #620 Epoxy System**] [**Euco #452 LV**] [**Euco #620 LV**] [**or**] [**Eucopoxy Injection Resin**].
d. Kaufman Products, Inc.; [**Surepoxy HMLV**] [**Surepoxy HMLV-Class B**] [**or**] [**Surepoxy HM-SLV**].
e. MBT Protection and Repair, Div. of ChemRex; [**Concresive Standard LVI**] [**or**] [**SCB Concresive 1380**].
f. Meadows, W. R., Inc.; Sealtight Rezi-Weld LV.
g. Sika Corporation; [**Sikadur 35, Hi-Mod LV**] [**Sikadur 35, Hi-Mod LV LPL**] [**Sikadur 52**] [**or**] [**Sikadur Injection Gel**].
h. Sonneborn, Div. of ChemRex; [**Epofil**] [**or**] [**Epofil SLV**].
i. Tamms Industries, Inc.; Duralcrete LV.
j. Thermal-Chem; Crack Injection, Product [**2**] [**205**] [**or**] [**212**].
k. ThorRoc, Div. of ChemRex, Inc.; [**LV300 Injection Resin**] [**or**] [**ULV140 Injection Resin**].

l. Unitex; [**Pro-Poxy 50 SuperLV**] [**Pro-Poxy 100 LV**] [**or**] [**Slow Set Injection Resin**].
m. US MIX Products Company; US Spec Maxi - Bond 500LV.
n. <**Insert manufacturer's name; product name or designation.**>

D. Capping Adhesive: Product manufactured for use with crack injection adhesive by same manufacturer.

E. Corrosion-Inhibiting Treatment Materials: Water-based solution of alkaline corrosion-inhibiting chemicals that penetrates concrete by diffusion and forms a protective film on steel reinforcement.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Cortec Corporation; [**MCI 2005**] [**or**] [**MCI 2020**].
b. Degussa Corporation; Protectosil CIT.
c. Fox industries, Inc.; FX-361 Migratory Corrosion Inhibitor.
d. Sika Corporation; Sika Ferrogard 903.
e. Sonneborn, Div. of ChemRex; Corrosion Inhibitor.
f. <**Insert manufacturer's name; product name or designation.**>

F. Polymer Overlay: Epoxy adhesive complying with ASTM C 881/C 881M, Type III.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Kaufman Products, Inc.; [**Surepoxy VLM**] [**or**] [**Surepoxy VLM-Class B**].
b. Meadows, W. R., Inc.; Sealtight Rezi-Weld Type III DOT.
c. Thermal-Chem; Flexgard T, Product 309.
d. Unitex; Pro-Poxy Type III D.O.T.
e. US MIX Products Company; US SPEC Type III Epoxy Binder.
f. <**Insert manufacturer's name; product name or designation.**>

G. Aggregate for Use with Polymer Overlay: Oven-dried, washed silica sand complying with ACI 503.3.

H. Polymer Sealer: Low-viscosity [**epoxy**] [**or**] [**high-molecular-weight methacrylate**] penetrating sealer recommended by manufacturer for application to exterior concrete traffic surfaces.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Epoxy Sealers:

1) ChemCo Systems; CCS Coating, Epoxy Healer Sealer.
2) Euclid Chemical Company (The); Euco #512 Epoxy Sealer.

3) Fox Industries, Inc.; FX-452 Epoxy Penetrating Sealer.
4) Kaufman Products, Inc.; SurePoxy Penetrating Sealer.
5) MBT Protection and Repair, Div. of ChemRex; Masterseal GP.
6) Thermal-Chem; Hairline Crack Sealer, Product 207.
7) Unitex; Pro-Seal HS.
8) US MIX Products Company; US Spec Eposeal LVS.
9) <**Insert manufacturer's name; product name or designation.**>

b. High-Molecular-Weight Methacrylate Sealers:

1) Meadows, W. R. Inc.; Sealtight Vocomp-25.
2) Sika Corporation; Sikapronto 19.
3) Transpo Industries, Inc.; Sealate T70.
4) <**Insert manufacturer's name; product name or designation.**>

I. Methylmethacrylate Sealer/Brighteners: Clear low-viscosity sealer recommended by manufacturer for sealing exterior exposed-aggregate concrete, and formulated to bring out color of aggregates and give concrete a wet look.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Dayton Superior Corporation; [**Day-Chem Aggre-Gloss (J-25)**] [**or**] [**Safe Seal Heavy Duty (J-24 HD)**].
b. Kaufman Products, Inc.; [**Sureal**] [**or**] [**Sureal Emulsion**].
c. Meadows, W. R., Inc.; Sealtight CS-309-25.
d. Tamms Industries, Inc.; Luster Seal 300.
e. Unitex; Bright Rock Sealer.
f. US MIX Products Company; [**US Spec BRS-25**] [**or**] [**US Spec Radiance UV-25**].
g. <**Insert manufacturer's name; product name or designation.**>

J. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

1. After fabricating, prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. After preparation, apply one coat of lead- and chromate-free, modified-alkyd primer complying with MPI#76 and one coat of alkyd-gloss enamel complying with MPI#96.
3. After preparation, apply two-coat high-performance coating system consisting of organic zinc-rich primer, complying with SSPC-Paint 20 or SSPC-Paint 29 and topcoat of high-build, urethane or epoxy coating recommended by manufacturer for application over specified zinc-rich primer. Comply with coating manufacturer's written directions and with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
b. Products: Subject to compliance with requirements, provide one of the following:

1) Benjamin Moore & Co.; Epoxy Zinc-Rich Primer CM18/19 and M74/M75 Aliphatic Acrylic Urethane Semi-Gloss.
2) Carboline Company; Carbozinc 621 and Carboguard 890 2-Component Epoxy.
3) ICI Devoe Coatings; Catha-Coat 313 and Devthane 378 Aliphatic Urethane Semi-Gloss Enamel
4) International Coatings Limited; Interzinc 315 Epoxy Zinc-Rich Primer and Interthane 870.
5) PPG Architectural Finishes, Inc; Aquapon Zinc-Rich Primer ABC 97-670 and Aquapon 97-130 Epoxy.
6) Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer and Macropoxy HS High Solids Epoxy.
7) Tnemec Company, Inc.; Tneme-Zinc 90-97 and Series 27 Hi-Build Epoxy.
8) <**Insert manufacturer's name; product name or designation.**>

K. Bolts, Nuts, and Washers: Carbon steel; ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), for bolts; ASTM A 563 (ASTM A 563M), Grade A, for nuts; and ASTM F 436 (ASTM F 436M) for washers; hot-dip or mechanically zinc coated.

L. Postinstalled Anchors: [**Chemical**] [**or**] [**expansion**] anchors, made from stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Alloy Group A1 or A4) for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors, with capability to sustain, without failure, a load equal to four times the load imposed, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

M. Composite Structural Reinforcement: Manufacturer's system consisting of [**carbon**] [**glass**]-fiber reinforcement in the form of [**preimpregnated sheets**] [**or**] [**tow sheet with field-applied saturant**], and epoxy primers, fillers, adhesives, saturants, and topcoats, designed for use as external structural reinforcement for concrete.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Sika Corporation; Carbodur and Sikadur 30.
b. Sumitomo Corporation of America; Replark.
c. Thermal-Chem; Epic Systems.
d. VSL (VStructural, LLC), a Structural Group Company; V-Wrap [**C100**] [**or**] [**C200**].
e. VSL (VStructural, LLC), a Structural Group Company; V-Wrap EG50.
f. Watson Bowman Acme Corp., Degussa AG; Wabo MBrace.
g. <**Insert manufacturer's name; product name or designation.**>

## 2.5 MIXES

A. Mix products, in clean containers, according to manufacturer's written instructions.

1. Add clean silica sand and coarse aggregates to products only as recommended by manufacturer.

2. Do not add water, thinners, or additives unless recommended by manufacturer.
3. When practical, use manufacturer's premeasured packages to ensure that materials are mixed in proper proportions. When premeasured packages are not used, measure ingredients using graduated measuring containers; do not estimate quantities or use shovel or trowel as unit of measure.
4. Do not mix more materials than can be used within recommended open time. Discard materials that have begun to set.

B. Mortar Scrub-Coat: Mix with enough water to provide consistency of thick cream.

C. Dry-Pack Mortar: Mix with just enough liquid to form damp cohesive mixture that can be squeezed by hand into a ball but is not plastic.

D. Concrete: Comply with Division 3 Section "[**Cast-in-Place Concrete**] [**Cast-in-Place Concrete (Limited Applications)**]."

E. Shotcrete: Comply with Division 3 Section "Shotcrete."

F. Grout for Use with Preplaced Aggregate: Proportion according to ASTM C 938. Add grout fluidifier to mixing water followed by cementitious materials and then fine aggregate.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Notify Architect seven days in advance of dates when areas of deteriorated or delaminated concrete and deteriorated reinforcing bars will be located.

B. Locate areas of deteriorated or delaminated concrete using hammer or chain drag sounding and mark boundaries. Mark areas for removal by simplifying and squaring off boundaries[ **as directed by Architect**]. At columns and walls make boundaries level and plumb, unless otherwise indicated.

C. Locate at least three reinforcing bars using a pachometer, and drill test holes to determine depth of cover. Calibrate pachometer, using depth of cover measurements, and verify depth of cover in removal areas using pachometer.

### 3.2 PREPARATION

A. Protect people, motor vehicles, equipment, surrounding construction, Project site, plants, and surrounding buildings from injury resulting from concrete rehabilitation work.

1. Erect and maintain temporary protective covers over pedestrian walkways and at points of entrance and exit for people and vehicles, unless such areas are made inaccessible during the course of concrete rehabilitation work. Construct covers of tightly fitted, 3/4-inch (19-mm) exterior-grade plywood supported at 16 inches (405 mm) o.c. and covered with asphalt roll roofing.

2. Protect adjacent equipment and surfaces by covering them with heavy polyethylene film and waterproof masking tape[ **or a liquid strippable masking agent**]. If practical, remove items, store, and reinstall after potentially damaging operations are complete.
3. Neutralize and collect alkaline and acid wastes according to requirements of authorities having jurisdiction, and dispose of by legal means off Owner's property.
4. Dispose of runoff from wet operations by legal means and in a manner that prevents soil erosion, undermining of paving and foundations, damage to landscaping, and water penetration into building interiors.
5. Collect runoff from wet operations and dispose of by legal means off Owner's property.

B. Shoring: Install temporary supports before beginning concrete removal.

C. Concrete Removal:

1. Saw-cut perimeter of areas indicated for removal to a depth of at least [**1/2 inch (13 mm)**] <**Insert depth**>. Make cuts perpendicular to concrete surfaces and no deeper than cover on reinforcement.
2. Remove deteriorated and delaminated concrete by breaking up and dislodging from reinforcement.
3. Remove additional concrete, if necessary, to provide a depth of removal of at least [**1/2 inch (13 mm)**] <**Insert depth**> over entire removal area.
4. Where half or more of the perimeter of reinforcing bar is exposed, bond between reinforcing bar and surrounding concrete is broken, or reinforcing bar is corroded, remove concrete from entire perimeter of bar and to provide at least a 3/4-inch (19-mm) clearance around bar.
5. Test areas where concrete has been removed by tapping with hammer, and remove additional concrete until unsound and disbonded concrete is completely removed.
6. Provide fractured aggregate surfaces with a profile of at least 1/8 inch (3 mm) that are approximately perpendicular or parallel to original concrete surfaces. At columns and walls, make top and bottom surfaces level, unless otherwise directed.
7. Thoroughly clean removal areas of loose concrete, dust, and debris.

D. Reinforcing Bar Preparation: Remove loose and flaking rust from reinforcing bars by [**high-pressure water cleaning**] [**abrasive blast cleaning**] [**needle scaling**] [**or**] [**wire brushing**] until only tightly bonded light rust remains.

1. Where section loss of reinforcing bar is more than 25 percent, or 20 percent in 2 or more adjacent bars, cut bars and remove and replace[ **as directed by Architect**]. Remove additional concrete as necessary to provide at least 3/4-inch (19-mm) clearance at existing and replacement bars. Splice replacement bars to existing bars according to ACI 318 (ACI 318M), by lapping, welding, or using mechanical couplings.

E. Preparation of Floor Joints for Repair: Saw-cut joints full width to edges and depth of spalls, but not less than [**3/4 inch (19 mm)**] [**1 inch (25 mm)**] [**2 inches (50 mm)**] <**Insert depth**> deep. Clean out debris and loose concrete; vacuum or blow clear with compressed air.

F. Surface Preparation for Corrosion-Inhibiting Treatment: Clean concrete by [**low-pressure water cleaning**] [**detergent scrubbing**] [**or**] [**sand blasting**] to remove dirt, oils, films, and other materials detrimental to treatment application. Allow surface to dry before applying corrosion-inhibiting treatment.

G. Surface Preparation for Overlays: [**Remove delaminated material and deteriorated concrete surface material.** ]Roughen surface of concrete by [**sand blasting**] [**shot blasting**] [**scarifying**] [**needle scaling**] [**high-pressure water jetting**] [**scabbling**] [**flame blasting**] [**or**] [**milling**] to produce a surface profile matching CSP [**3**] [**4**] [**5**] [**6**] [**7**] [**8**] [**9**] per ICRI 03732. Sweep and vacuum roughened surface to remove debris followed by low-pressure water cleaning.

H. Surface Preparation for Sealers: Clean concrete by [**shot blasting**] [**low-pressure water cleaning**] [**or**] [**detergent scrubbing**] to remove dirt, oils, films, and other materials detrimental to sealer application.

I. Surface Preparation for Sealers: Acid etch surface of concrete to produce a surface profile matching CSP 1 per ICRI 03732.[ **Prepare surface for acid etching by detergent scrubbing to remove oils and films that may prevent acid penetration.**]

1. Remove excess acid solution, reaction products, and debris by squeegeeing or vacuuming.
2. Scrub surface with an alkaline detergent, rinse, and squeegee or vacuum.
3. Check acidity of surface with pH test paper and continue rinsing until pH is acceptable.
4. When pH is acceptable and surface is clean, vacuum dry.

J. Surface Preparation for Composite Structural Reinforcement: [**Remove delaminated material and deteriorated concrete surface material.** ]Clean concrete where reinforcement and epoxy patching mortar is to be applied by [**low-pressure water cleaning**] [**or**] [**detergent scrubbing**] to remove dirt, oils, films, and other materials detrimental to epoxy application. Roughen surface of concrete by sand blasting.

## 3.3 APPLICATION

A. General: Comply with manufacturer's written instructions and recommendations for application of products, including surface preparation.

B. Epoxy-Modified, Cementitious Bonding and Anticorrosion Agent: Apply to reinforcing bars [**and concrete** ]by stiff brush or hopper spray according to manufacturer's written instructions. Apply to reinforcing bars in two coats, allowing first coat to dry two to three hours before applying second coat. Allow to dry before placing patching mortar or concrete.

C. Epoxy Bonding Agent: Apply to reinforcing bars[ **and concrete**] by brush, roller, or spray according to manufacturer's written instructions, leaving no pinholes or other uncoated areas. [**Apply to reinforcing bars in at least two coats, allowing first coat to dry before applying second coat.** ]Apply patching mortar or concrete while epoxy is still tacky. If epoxy dries, recoat before placing patching mortar or concrete.

D. Latex Bonding Agent, Type II: Mix with portland cement and scrub into concrete surface according to manufacturer's written instructions. Apply patching mortar or concrete while bonding agent is still wet. If bonding agent dries, recoat before placing patching mortar or concrete.

E. Latex Bonding Agent, Type I: Apply to concrete by brush roller or spray. Allow to dry before placing patching mortar or concrete.

F. Mortar Scrub-Coat: Dampen repair area and surrounding concrete 6 inches (150 mm) beyond repair area. Remove standing water and apply scrub-coat with a brush, scrubbing it into surface and thoroughly coating repair area. If scrub-coat dries, recoat before applying patching mortar or concrete.

G. Patching Mortar: Unless otherwise recommended by manufacturer, apply as follows:

1. Wet substrate thoroughly and then remove standing water. Scrub a slurry of neat patching mortar[ **mixed with latex bonding agent**] into substrate, filling pores and voids.
2. Place patching mortar by troweling toward edges of patch to force intimate contact with edge surfaces. For large patches, fill edges first and then work toward center, always troweling toward edges of patch. At fully exposed reinforcing bars, force patching mortar to fill space behind bars by compacting with trowel from sides of bars.
3. For vertical patching, place material in lifts of not more than [**1 inch (25 mm)**] [**1-1/2 inches (38 mm)**] [**2 inches (50 mm)**] [**3 inches (75 mm)**] nor less than [**1/8 inch (3 mm)**] [**1/4 inch (6 mm)**]. Do not feather edge.
4. For overhead patching, place material in lifts of not more than [**1 inch (25 mm)**] [**1-1/2 inches (38 mm)**] [**2 inches (50 mm)**] nor less than [**1/8 inch (3 mm)**] [**1/4 inch (6 mm)**]. Do not feather edge.
5. After each lift is placed, consolidate material and screed surface.
6. Where multiple lifts are used, score surface of lifts to provide a rough surface for application of subsequent lifts. Allow each lift to reach final set before placing subsequent lifts.
7. Allow surfaces of lifts that are to remain exposed to become firm and then finish to a [**smooth**] [**rough**] surface with a [**wood or sponge float**] [**broom or burlap drag**].
8. Wet-cure cementitious patching materials, including polymer-modified, cementitious patching materials, for not less than seven days by water-fog spray or water-saturated absorptive cover.

H. Dry-Pack Mortar: Use for deep cavities[ **and where indicated**]. Unless otherwise recommended by manufacturer, apply as follows:

1. Provide forms where necessary to confine patch to required shape.
2. Wet substrate and forms thoroughly and then remove standing water.
3. Place dry-pack mortar into cavity by hand, and compact into place with a hardwood drive stick and mallet or hammer. Do not place more material at a time than can be properly compacted. Continue placing and compacting until patch is approximately level with surrounding surface.
4. After cavity is filled and patch is compacted, trowel surface to match profile and finish of surrounding concrete. A thin coat of patching mortar may be troweled into the surface of patch to help obtain required finish.
5. Wet-cure patch for not less than seven days by water-fog spray or water-saturated absorptive cover.

I. Concrete: Place according to Division 3 Section "[**Cast-in-Place Concrete**] [**Cast-in-Place Concrete (Limited Applications)**]" and as follows:

1. Apply [**epoxy-modified, cementitious bonding and anticorrosion agent**] [**epoxy bonding agent**] to reinforcement[ **and concrete substrate**].
2. Apply [**latex bonding agent**] [**Type I, latex bonding agent**] [**mortar scrub-coat**] to concrete substrate.

3. Use vibrators to consolidate concrete as it is placed.
4. At unformed surfaces, screed concrete to produce a surface that when finished with patching mortar will match required profile and surrounding concrete.
5. [**Where indicated** ]place concrete by form and pump method.

    a. Design and construct forms to resist pumping pressure in addition to weight of wet concrete. Seal joints and seams in forms and junctions of forms with existing concrete.
    b. Pump concrete into place, releasing air from forms as concrete is introduced. When formed space is full, close air vents and pressurize to 14 psi (96 kPa).

6. Wet-cure concrete for not less than seven days by leaving forms in place or keeping surfaces continuously wet by water-fog spray or water-saturated absorptive cover.
7. Fill placement cavities with dry-pack mortar and repair voids with patching mortar. Finish to match surrounding concrete.

J. Shotcrete: Place according to Division 3 Section "Shotcrete" and as follows:

1. Apply [**epoxy-modified, cementitious bonding and anticorrosion agent**] [**epoxy bonding agent**] to reinforcement[ **and concrete substrate**].
2. Apply [**latex bonding agent**] [**Type I, latex bonding agent**] [**mortar scrub-coat**] to concrete substrate.
3. Screed and finish shotcrete to produce a surface matching required profile and surrounding concrete.

K. Grouted Preplaced Aggregate Concrete: Use [**for column and wall repairs**] [**where indicated**]. Place as follows:

1. Design and construct forms to resist pumping pressure in addition to weight of wet grout. Seal joints and seams in forms and junctions of forms with existing concrete.
2. Apply [**epoxy-modified, cementitious bonding and anticorrosion agent**] [**epoxy bonding agent**] to reinforcement[ **and concrete substrate**].
3. Place aggregate in forms, consolidating aggregate as it is placed. Pack aggregate into upper areas of forms to achieve intimate contact with concrete surfaces.
4. Fill forms with water to thoroughly dampen aggregate and substrates. Drain water from forms before placing grout.
5. Pump grout into place at bottom of preplaced aggregate, forcing grout upward. Release air from forms at top as grout is introduced. When formed space is full and grout flows from air vents, close vents and pressurize to 14 psi (96 kPa).
6. Wet-cure concrete for not less than seven days by leaving forms in place or keeping surfaces continuously wet by water-fog spray or water-saturated absorptive cover.
7. Repair voids with patching mortar and finish to match surrounding concrete.

L. Joint Filler: Install in nonmoving floor joints where indicated.

1. Install filler to a depth of at least [**3/4 inch (19 mm)**] [**1 inch (25 mm)**] [**2 inches (50 mm)**] <**Insert depth**>. Use fine silica sand no more than 1/4 inch (6 mm) deep to close base of joint. Do not use sealant backer rods or compressible fillers below joint filler.
2. Install filler so that when cured, it is flush at top surface of adjacent concrete. If necessary, overfill joint and remove excess when filler has cured.

M. Epoxy Crack Injection: Comply with manufacturer's written instructions and the following:

1. Clean areas to receive capping adhesive of oil, dirt, and other substances that would interfere with bond, and clean cracks with oil-free compressed air or low-pressure water to remove loose particles.
2. Place injection ports as recommended by epoxy manufacturer, spacing no farther apart than thickness of member being injected. Seal injection ports in place with capping adhesive.
3. Seal cracks at exposed surfaces with a ribbon of capping adhesive at least 1/4 inch (6 mm) thick by 1 inch (25 mm) wider than crack.
4. Inject cracks wider than 0.003 inch (0.075 mm) to a depth of 8 inches (200 mm) or to a width of less than 0.003 inch (0.075 mm), whichever is less.
5. Inject epoxy adhesive, beginning at widest part of crack and working toward narrower parts. Inject adhesive into ports to refusal, capping adjacent ports when they extrude epoxy. Cap injected ports and inject through adjacent ports until crack is filled.
6. After epoxy adhesive has set, remove injection ports and grind surfaces smooth.

N. Corrosion-Inhibiting Treatment: Apply by brush, roller, or airless spray in two coats at manufacturer's recommended application rate. Remove film of excess treatment by high-pressure washing before patching treated concrete[ **or applying a sealer or overlay**].

1. Apply to the following: <**Insert locations where treatment is to be applied.**>

O. Polymer Overlay: Apply according to ACI 503.3.

1. Apply to traffic-bearing surfaces, including parking areas and walks.

P. Polymer Sealer: Apply by brush, roller, or airless spray at manufacturer's recommended application rate.

1. Apply to traffic-bearing surfaces, including parking areas and walks.

Q. Methylmethacrylate Sealer/Brighteners: Apply by brush, roller, or airless spray at manufacturer's recommended application rate.

1. Apply to exterior concrete surfaces that are exposed to view, excluding traffic-bearing surfaces.

R. Composite Structural Reinforcement Using Preimpregnated Fiber Sheet: Unless otherwise recommended by manufacturer, apply as follows:

1. Patch surface defects with epoxy mortar and allow to set before beginning reinforcement application.
2. Apply epoxy adhesive to a thickness of 1/16 inch (1.6 mm) to prepared concrete surfaces in areas where composite structural reinforcement will be applied.
3. Clean preimpregnated fiber sheet with acetone or other suitable solvent, and apply epoxy adhesive to a thickness of 1/16 inch (1.6 mm).
4. Apply adhesive-coated fiber sheet to adhesive-coated concrete within open time of epoxy adhesive, and roll with a hard rubber roller until fiber sheet is fully embedded in adhesive, air pockets are removed, and adhesive is forced out from beneath fiber sheet at edges.

5. Apply additional layers as indicated using same procedure.

S. Composite Structural Reinforcement Using Fiber Tow Sheet and Saturant: Unless otherwise recommended by manufacturer, apply as follows:

1. Apply epoxy primer using brush or short nap roller to prepared concrete surfaces in areas where composite structural reinforcement will be applied.
2. After primer has set, patch surface defects with epoxy filler and allow to set before beginning reinforcement application.
3. Apply epoxy saturant to [**fiber tow sheet**] [**or**] [**primed and patched surface**] with 3/8-inch- (10-mm-) nap roller. Apply fiber tow sheet to primed and patched surface while saturant is still wet, using pressure roller to remove air pockets. Remove paper backing from fiber tow sheet and apply additional epoxy as needed to fully saturate tow sheet.
4. Apply additional layers as indicated, fully saturating each with epoxy.
5. After saturant has cured, apply protective topcoat by [**brush**] [**roller**] [**or**] [**spray**].

## 3.4 FIELD QUALITY CONTROL

A. Testing Agency: [**Owner will engage**] [**Engage**] a qualified testing agency to sample materials and perform tests as follows:

1. Patching Mortar, Packaged Mixes: <**Insert number**> randomly selected samples tested according to ASTM C 928.
2. Patching Mortar, Field Mixed: <**Insert number**> randomly selected samples tested for compressive strength according to ASTM C 109/C 109M.
3. Concrete: As specified in Division 3 Section "[**Cast-in-Place Concrete**] [**Cast-in-Place Concrete (Limited Applications)**]."
4. Shotcrete: As specified in Division 3 Section "Shotcrete."
5. Grouted Preplaced Aggregate: Tested for compressive strength of grout according to ASTM C 942.

    a. Testing Frequency: One sample for each 25 cu. yd. (19 cu. m) of grout or fraction thereof, but not less than one sample for each day's work.

6. Joint Filler: Core drilled samples to verify proper installation.

    a. Testing Frequency: One sample for each 100 feet (30 m) of joint filled.
    b. Where samples are taken, fill holes with joint filler.

7. Epoxy Crack Injection: Core drilled samples to verify proper installation.

    a. Testing Frequency: [**3 samples from mockup and** ]1 sample for each 100 feet (30 m) of crack injected.
    b. Where samples are taken, fill holes with epoxy mortar.

END OF SECTION 03930

# Division 4 – Mansonry

# Division 5 – Metals

SECTION 05120 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Structural steel.
2. Architecturally exposed structural steel.
3. Prefabricated building columns.
4. Grout.

B. Related Sections include the following:

1. Division 1 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
2. Division 5 Section "Steel Deck" for field installation of shear connectors.
3. Division 5 Section "Metal Fabrications" for [**steel lintels or shelf angles not attached to structural-steel frame**] [**miscellaneous steel fabrications**] [**and**] [**other metal items**] not defined as structural steel.
4. [**Division 9 painting Sections**] [**and**] [**Division 9 Section "High-Performance Coatings"**] for surface preparation and priming requirements.
5. Division 13 Section "Metal Building Systems" for structural steel.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

B. Architecturally Exposed Structural Steel: Structural steel designated as architecturally exposed structural steel in the Contract Documents.

1.4 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of[ **simple shear**] connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand [**ASD-service**] [**LRFD**] loads indicated and comply with other information and restrictions indicated.

1. Select and complete connections using [**schematic details indicated**] [**and**] [**AISC's "Manual of Steel Construction, Load and Resistance Factor Design," Volume 2,**

**Part 9**] [**AISC's "Manual of Steel Construction, Allowable Stress Design," Part 4**] <**Insert source**>.

2. Engineering Responsibility: Fabricator's responsibilities include using a qualified professional engineer to prepare structural analysis data for structural-steel connections.

B. Construction: Type [**PR, partially**] [**FR, fully**] restrained.

C. Construction: Type [**1, rigid frame**] [**2, simple framing**] [**3, semirigid framing**].

## 1.5 SUBMITTALS

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

B. Shop Drawings: Show fabrication of structural-steel components.

1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
5. For structural-steel connections indicated to comply with design loads, include structural analysis data [**signed and sealed**] [**prepared**] by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

D. Qualification Data: For [**Installer**] [**fabricator**] [**professional engineer**] [**testing agency**].

E. Mill Test Reports: Signed by manufacturers certifying that the following products comply with requirements:

1. Structural steel including chemical and physical properties.
2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
3. Direct-tension indicators.
4. Tension-control, high-strength bolt-nut-washer assemblies.
5. Shear stud connectors.
6. Shop primers.
7. Nonshrink grout.
8. <**Insert product.**>

F. Source quality-control test reports.

## 1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category [**CASE**] [**CSE**].

B. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category [**Cbd**] [**Sbd**].

C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement [**P1**] [**P2**] [**P3**] or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."

D. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

E. Comply with applicable provisions of the following specifications and documents:

1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. AISC's "Seismic Provisions for Structural Steel Buildings" and "Supplement No. 2."
3. AISC's "[**Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design**] [**Load and Resistance Factor Design Specification for Structural Steel Buildings**]."
4. AISC's "Specification for the Design of Steel Hollow Structural Sections."
5. AISC's "[**Specification for Allowable Stress Design of Single-Angle Members**] [**Specification for Load and Resistance Factor Design of Single-Angle Members**]."
6. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

F. Mockups: Build mockups of architecturally exposed structural steel to set quality standards for fabrication and installation.

1. Coordinate finish painting requirements with Division 9 painting Sections.
2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

## 1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

## 1.8 COORDINATION

A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: [**ASTM A 992/A 992M**] [**ASTM A 572/A 572M, Grade 50 (345)**] [**ASTM A 529/A 529M, Grade 50 (345)**] [**ASTM A 913/A 913M, Grade 50 (345)**].

B. Channels, Angles[**, M**] [**, S**]-Shapes: [**ASTM A 36/A 36M**] [**ASTM A 572/A 572M, Grade 50 (345)**] [**ASTM A 529/A 529M, Grade 50 (345)**] [**ASTM A 913/A 913M, Grade 50 (345)**].

C. Plate and Bar: [**ASTM A 36/A 36M**] [**ASTM A 572/A 572M, Grade 50 (345)**] [**ASTM A 529/A 529M, Grade 50 (345)**].

D. Corrosion-Resisting Structural Steel: ASTM A 588/A 588M, Grade 50 (345).

E. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade [**B**] [**C**], structural tubing.

F. Corrosion-Resisting Cold-Formed Hollow Structural Sections: ASTM A 847, structural tubing.

G. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.

1. Weight Class: [**Standard**] [**Extra strong**] [**Double-extra strong**].
2. Finish: [**Black**] [**Galvanized**] [**Black, except where indicated to be galvanized**].

H. Medium-Strength Steel Castings: ASTM A 27/A 27M, Grade 65-35 (Grade 450-240), carbon steel.

I. High-Strength Steel Castings: ASTM A 148/A 148M,Grade 80-50 (Grade 550-345), carbon or alloy steel.

J. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers.

1. Finish: [**Plain**] [**Hot-dip zinc coating, ASTM A 153/A 153M, Class C**] [**Mechanically deposited zinc coating, ASTM B 695, Class 50**].
2. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8,) compressible-washer type.

a. Finish: [**Plain**] [**Mechanically deposited zinc coating, ASTM B 695, Class 50**] [**Mechanically deposited zinc coating, ASTM B 695, Class 50, baked epoxy coated**].

B. High-Strength Bolts, Nuts, and Washers: ASTM A 490 (ASTM A 490M), Type 1, heavy hex steel structural bolts[ **or tension-control, bolt-nut-washer assemblies with splined ends**];

ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers, plain.

1. Direct-Tension Indicators: ASTM F 959, Type 490 (ASTM F 959M,) Type 10.9, compressible-washer type, plain.

C. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, [**heavy hex**] [**round**] head steel structural bolts with splined ends; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers.

1. Finish: [**Plain**] [**Mechanically deposited zinc coating, ASTM B 695, Class 50**].

D. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1, Type B.

E. Unheaded Anchor Rods: [**ASTM F 1554, Grade 36**] [**ASTM F 1554, Grade 55, weldable**] [**ASTM A 354**] [**ASTM A 449**] [**ASTM A 572/A 572M, Grade 50 (345)**] [**ASTM A 36/A 36M**] [**ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6)**].

1. Configuration: [**Straight**] [**Hooked**].
2. Nuts: ASTM A 563 (ASTM A 563M) [**heavy** ]hex carbon steel.
3. Plate Washers: ASTM A 36/A 36M carbon steel.
4. Washers: ASTM F 436 (ASTM F 436M) hardened carbon steel.
5. Finish: [**Plain**] [**Hot-dip zinc coating, ASTM A 153/A 153M, Class C**] [**Mechanically deposited zinc coating, ASTM B 695, Class 50**].

F. Headed Anchor Rods: [**ASTM F 1554, Grade 36**] [**ASTM F 1554, Grade 55, weldable**] [**ASTM A 354**] [**ASTM A 449**] [**ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6)**], straight.

1. Nuts: ASTM A 563 (ASTM A 563M) [**heavy** ]hex carbon steel.
2. Plate Washers: ASTM A 36/A 36M carbon steel.
3. Washers: ASTM F 436 (ASTM F 436M) hardened carbon steel.
4. Finish: [**Plain**] [**Hot-dip zinc coating, ASTM A 153/A 153M, Class C**] [**Mechanically deposited zinc coating, ASTM B 695, Class 50**].

G. Threaded Rods: [**ASTM A 193/A 193M**] [**ASTM A 354**] [**ASTM A 449**] [**A 572/A 572M, Grade 50 (345)**] [**ASTM A 36/A 36M**] [**ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6)**].

1. Nuts: ASTM A 563 (ASTM A 563M) [**heavy** ]hex carbon steel.
2. Washers: [**ASTM F 436 (ASTM F 436M) hardened**] [**ASTM A 36/A 36M**] carbon steel.
3. Finish: [**Plain**] [**Hot-dip zinc coating, ASTM A 153/A 153M, Class C**] [**Mechanically deposited zinc coating, ASTM B 695, Class 50**].

H. [**Clevises**] [**Turnbuckles**]: ASTM A 108, Grade 1035, cold-finished carbon steel.

I. Eye Bolts and Nuts: ASTM A 108, Grade 1030, cold-finished carbon steel.

J. Sleeve Nuts: ASTM A 108, Grade 1018, cold-finished carbon steel.

2.3 PRIMER

A. Primer: SSPC-Paint 25, Type [**I**] [**II**], iron oxide, zinc oxide, raw linseed oil, and alkyd.

B. Primer: SSPC-Paint 25 BCS, Type [**I**] [**II**], iron oxide, zinc oxide, raw linseed oil, and alkyd.

C. Primer: SSPC-Paint 23, latex primer.

D. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer.

E. Galvanizing Repair Paint: [**MPI#18, MPI#19, or SSPC-Paint 20**] [**ASTM A 780**].

2.4 GROUT

A. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404, Size No. 2. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

B. Metallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, metallic aggregate grout, mixed with water to consistency suitable for application and a 30-minute working time.

C. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "[**Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design**] [**Load and Resistance Factor Design Specification for Structural Steel Buildings**]."

1. Camber structural-steel members where indicated.
2. Identify high-strength structural steel according to ASTM A 6/ A 6M and maintain markings until structural steel has been erected.
3. Mark and match-mark materials for field assembly.
4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Architecturally Exposed Structural Steel: Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel identified as architecturally exposed structural steel.

1. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale,[ **seam marks, roller marks, rolled trade names,**] and roughness.
2. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.

C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.

D. Bolt Holes: Cut, drill, [**mechanically thermal cut,** ]or punch standard bolt holes perpendicular to metal surfaces.

E. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

F. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to [**SSPC-SP 1, "Solvent Cleaning**] [**SSPC-SP 2, "Hand Tool Cleaning**] [**SSPC-SP 3, "Power Tool Cleaning**]."

G. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

H. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.

I. Welded Door Frames: Build up welded door frames attached to structural steel. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk, cross-recessed head machine screws, uniformly spaced not more than 10 inches (250 mm) o.c., unless otherwise indicated.

J. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.

1. Cut, drill, or punch holes perpendicular to steel surfaces.[ **Do not thermally cut bolt holes or enlarge holes by burning.**]
2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

## 2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: [**Snug tightened**] [**Pretensioned**] [**Slip critical**].

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances.[ **Prevent weld show-through on exposed steel surfaces.**]

   a. Grind butt welds flush.
   b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

## 2.7 PREFABRICATED BUILDING COLUMNS

A. General: Prefabricated building columns consisting of load-bearing structural-steel members encased in manufacturer's standard insulating concrete for fire protection and enclosed in an outer non-load-bearing steel shell.

1. Concrete Fill: Manufacturer's standard-mix structural concrete, with a minimum 28-day compressive strength of 5000 psi (34.5 MPa), machine mixed and mechanically vibrated during placement to produce concrete fill free of voids.

B. Fire-Resistance Ratings: Provide prefabricated building column listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for ratings indicated, based on testing according to ASTM E 119.

1. Fire-Resistance Rating: [**4**] [**3**] [**2**] hours.

C. Column Configuration: Provide columns of sizes and shapes indicated. Fabricate connections to comply with details shown or as required to suit type of structure indicated.

D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering prefabricated building columns that may be incorporated into the Work include, but are not limited to, the following:

E. Manufacturers: Subject to compliance with requirements, provide prefabricated building columns by one of the following:

1. Black Rock Column, Inc.
2. Dean, George H. Inc.
3. Fire-Trol Division; Dean Lally L.P.

## 2.8 SHOP PRIMING

A. Shop prime steel surfaces except the following:

1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
2. Surfaces to be field welded.
3. Surfaces to be high-strength bolted with slip-critical connections.
4. Surfaces to receive sprayed fire-resistive materials.
5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

1. SSPC-SP 2, "Hand Tool Cleaning."
2. SSPC-SP 3, "Power Tool Cleaning."
3. SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning."
4. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
5. SSPC-SP 7/NACE No. 4, "Brush-Off Blast Cleaning."
6. SSPC-SP 8, "Pickling."
7. SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning."
8. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
9. SSPC-SP 14/NACE No. 8, "Industrial Blast Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Apply a 1-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils (0.038 mm).

## 2.9 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/ A 123M.

1. Fill vent holes and grind smooth after galvanizing.
2. Galvanize [**lintels**] [**shelf angles**] attached to structural-steel frame and located in exterior walls.

## 2.10 SOURCE QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be[ **tested and**] inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:

1. Bend tests will be performed if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

### 3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "[**Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design**] [**Load and Resistance Factor Design Specification for Structural Steel Buildings**]."

B. Base[ **and Bearing**] Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base[ **and bearing**] plates. Clean bottom surface of base[ **and bearing**] plates.

1. Set base[ **and bearing**] plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of base plate.
3. [**Snug-tighten**] [**Pretension**] anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base[ **or bearing**] plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and base[ **or bearing**] plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure.[ **Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.**]

C. Maintain erection tolerances of structural steel[ **and architecturally exposed structural steel**] within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

G. Do not use thermal cutting during erection[ **unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1**].

H. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

I. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

## 3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: [**Snug tightened**] [**Pretensioned**] [**Slip critical**].

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.

1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "[**Specification for Structural Steel Buildings--Allowable Stress Design and Plastic**

**Design**] [**Load and Resistance Factor Design Specification for Structural Steel Buildings**]" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.

2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances.[ **Prevent weld show-through on exposed steel surfaces.**]

    a. Grind butt welds flush.
    b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

## 3.5 PREFABRICATED BUILDING COLUMNS

A. Install prefabricated building columns to comply with AISC's "[**Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design**] [**Load and Resistance Factor Design Specification for Structural Steel Buildings**]," manufacturer's written recommendations, and requirements of testing and inspecting agency that apply to the fire-resistance rating indicated.

## 3.6 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect [**field welds**] [**and**] [**high-strength bolted connections**].

B. Bolted Connections: Shop-bolted connections will be[ **tested and**] inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1.

1. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:

    a. Liquid Penetrant Inspection: ASTM E 165.
    b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
    c. Ultrasonic Inspection: ASTM E 164.
    d. Radiographic Inspection: ASTM E 94.

D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1 for stud welding and as follows:

1. Perform bend tests if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

## 3.7 REPAIRS AND PROTECTION

A. Repair damaged galvanized coatings on galvanized items with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories[**, bearing plates,**] and abutting structural steel.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

C. Touchup Painting: Cleaning and touchup painting are specified in Division 9 painting Sections.

END OF SECTION 05120

SECTION 05500 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Steel framing and supports for ceiling-hung toilet compartments.
2. Steel framing and supports for operable partitions.
3. Steel framing and supports for overhead doors.
4. Steel framing and supports for countertops.
5. Steel framing and supports for mechanical and electrical equipment.
6. Steel framing and supports for applications where framing and supports are not specified in other Sections.
7. Steel framing and supports (outriggers) for window-washing equipment including [**mounting brackets**] [**and**] [**anchorages**].
8. [**Mounting brackets**] [**and**] [**anchorages**] for window-washing equipment.
9. Elevator machine beams[**, hoist beams,**] [**and**] [**divider beams**].
10. Support angles for elevator door sills.
11. Steel girders for supporting wood frame construction.
12. Steel pipe columns for supporting wood frame construction.
13. Prefabricated building columns.
14. Shelf angles.
15. Loose bearing and leveling plates.
16. Steel weld plates and angles for casting into concrete not specified in other Sections.
17. Structural-steel door frames.
18. Miscellaneous steel trim including [**steel angle corner guards**] [**steel edgings**] [**and**] [**loading-dock edge angles**].
19. Metal ladders.
20. Ladder safety cages.
21. Metal ships' ladders.
22. Metal bollards.
23. Pipe guards.
24. Bicycle racks.
25. Metal floor plate[ **and supports**].
26. Abrasive metal [**nosings**] [**treads**] [**and**] [**thresholds**].
27. Cast-iron wheel guards.
28. Metal downspout boots.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

C. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, wedge-type inserts and other items indicated to be cast into concrete.
2. Division 4 Section "Unit Masonry Assemblies" for installing loose lintels, anchor bolts, and other items indicated to be built into unit masonry.
3. Division 5 Section "Structural Steel."
4. Division 5 Section "Metal Stairs."
5. Division 5 Section "Pipe and Tube Railings."
6. Division 5 Section "Gratings."
7. Division 5 Section "Ornamental Metal."
8. Division 5 Section "Ornamental Railings."
9. Division 6 Section "[**Rough Carpentry**] [**Miscellaneous Carpentry**]" for metal framing anchors.
10. Division 6 Section "Heavy Timber Construction" for timber connectors.
11. Division 6 Section "Structural Glued-Laminated Timber" for timber connectors.
12. Division 10 Section "Wire Mesh Partitions."
13. Division 14 Section "Electric Traction Elevators" for [**elevator pit ladders**] [**and**] [**support angles for elevator door sills**].
14. Division 14 Section "Hydraulic Elevators" for [**elevator pit ladders**] [**and**] [**support angles for elevator door sills**].

## 1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.

B. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

## 1.4 SUBMITTALS

A. Product Data: For the following:

1. Nonslip aggregates and nonslip-aggregate surface finishes.
2. Prefabricated building columns.
3. Metal nosings and treads.
4. Paint products.
5. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.

1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
2. Provide templates for anchors and bolts specified for installation under other Sections.
3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Samples for Verification: For each type and finish of extruded [**nosing**] [**and**] [**tread**].

D. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.

E. Welding certificates.

F. Qualification Data: For professional engineer.

## 1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.6, "Structural Welding Code--Stainless Steel."

## 1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
2. Provide allowance for trimming and fitting at site.

## 1.7 COORDINATION

A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.3 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type [**304**] [**316L**].

C. Stainless-Steel Bars and Shapes: ASTM A 276, Type [**304**] [**316L**].

D. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.

E. Rolled-Stainless-Steel Floor Plate: ASTM A 793.

F. Abrasive-Surface Floor Plate: Steel plate [**with abrasive granules rolled into surface**] [**or**] [**with abrasive material metallically bonded to steel by a proprietary process**].

1. [**Available** ]Products:

a. IKG Industries, a Harsco company; Mebac.
b. W. S. Molnar Company; SlipNOT.
c. <**Insert manufacturer's name; product.**>

G. Steel Tubing: ASTM A 500, cold-formed steel tubing.

H. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

I. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-3.

1. Size of Channels: [**1-5/8 by 1-5/8 inches (41 by 41 mm)**] [**As indicated**].
2. Material: Galvanized steel complying with ASTM A 653/A 653M, [**commercial steel, Type B**] [**structural steel, Grade 33 (Grade 230)**], with G90 (Z275) coating; [**0.108-inch (2.8-mm)**] [**0.079-inch (2-mm)**] [**0.064-inch (1.6-mm)**] nominal thickness.
3. Material: Steel complying with ASTM A 1008/A 1008M, [**commercial steel, Type B**] [**structural steel, Grade 33 (Grade 230)**]; [**0.0966-inch (2.5-mm)**] [**0.0677-inch (1.7-mm)**] [**0.0528-inch (1.35-mm)**] minimum thickness; [**unfinished**] [**coated with rust-inhibitive, baked-on, acrylic enamel**] [**hot-dip galvanized after fabrication**].

J. Cast Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.

## 2.4 NONFERROUS METALS

A. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.

B. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.

C. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.

D. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.

E. Bronze Plate, Sheet, Strip, and Bars: ASTM B 36/B 36M, Alloy UNS No. C28000 (muntz metal, 60 percent copper).

F. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (extruded architectural bronze).

G. Bronze Castings: ASTM B 584, Alloy UNS No. C83600 (leaded red brass) or No. C84400 (leaded semired brass).

H. Nickel Silver Extrusions: ASTM B 151/B 151M, Alloy UNS No. C74500.

I. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

## 2.5 FASTENERS

A. General: Unless otherwise indicated, provide Type [**304**] [**316**] stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593 (ASTM F 738M) for bolts and ASTM F 594 (ASTM F 836M) for nuts, Alloy Group [**1 (A1)**] [**2 (A4)**].

D. Anchor Bolts: ASTM F 1554, Grade 36.

1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.

E. Eyebolts: ASTM A 489.

F. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).

G. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).

H. Wood Screws: Flat head, ASME B18.6.1.

I. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).

J. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).

K. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

L. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material for Anchors in Exterior Locations: Alloy Group [**1 (A1)**] [**2 (A4)**] stainless-steel bolts complying with ASTM F 593 (ASTM F 738M) and nuts complying with ASTM F 594 (ASTM F 836M).

## 2.6 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Division 9 [**painting Sections.**] [**Section "High-Performance Coatings."**]

C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.

1. Use primer with a VOC content of [**420 g/L (3.5 lb/gal.)**] <**Insert VOC limit**> or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

D. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.

1. Use primer with a VOC content of [**420 g/L (3.5 lb/gal.)**] <**Insert VOC limit**> or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. [**Available** ]Products:

a. Benjamin Moore & Co.; Epoxy Zinc-Rich Primer CM18/19.
b. Carboline Company; Carbozinc 621.
c. ICI Devoe Coatings; Catha-Coat 313.
d. International Coatings Limited; Interzinc 315 Epoxy Zinc-Rich Primer.
e. PPG Architectural Finishes, Inc.; Aquapon Zinc-Rich Primer 97-670.
f. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.
g. Tnemec Company, Inc.; Tneme-Zinc 90-97.
h. <**Insert manufacturer's name; product name or designation.**>

E. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

G. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.

H. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

I. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa), unless otherwise indicated.

## 2.7 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.

E. Weld corners and seams continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.

G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches (3.2 by 38 mm), with a minimum 6-inch (150-mm) embedment and 2-inch (50-mm) hook, not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c., unless otherwise indicated.

## 2.8 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Fabricate units from slotted channel framing where indicated.
2. Furnish inserts if units are installed after concrete is placed.

C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.

D. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.

1. Provide bearing plates welded to beams where indicated.
2. Drill girders and plates for field-bolted connections where indicated.
3. Where wood nailers are attached to girders with bolts or lag screws, drill holes at 24 inches (600 mm) o.c.

E. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness, unless otherwise indicated.

1. Unless otherwise indicated, fabricate from Schedule 40 steel pipe.
2. Unless otherwise indicated, provide 1/2-inch (12.7-mm) baseplates with four 5/8-inch (16-mm) anchor bolts and 1/4-inch (6.4-mm) top plates.

F. Galvanize miscellaneous framing and supports where indicated.

G. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

## 2.9 PREFABRICATED BUILDING COLUMNS

A. General: Provide prefabricated building columns consisting of load-bearing structural-steel members protected by insulating concrete fireproofing encased in an outer non-load-bearing steel shell.

B. Fire-Resistance Ratings: Provide prefabricated building columns listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for ratings indicated, based on testing according to ASTM E 119.

1. Fire-Resistance Rating: [**4 hours**] [**3 hours**] [**2 hours**] [**As indicated**].

C. Column Configuration: Provide columns of sizes and shapes indicated. Fabricate connections to comply with details shown or as needed to suit type of structure indicated.

1. Concrete Fill: Manufacturer's standard structural concrete, with minimum compressive strength of 4200 psi (29 MPa), machine mixed and mechanically vibrated during placement to produce concrete core free of voids.

D. [**Available** ]Manufacturers:

1. Black Rock Column, Inc.
2. Dean, George H., Inc.
3. Firetrol Division; Dean Lally L. P.
4. <**Insert manufacturer's name.**>

## 2.10 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches (200 mm), unless otherwise indicated.

C. Galvanize loose steel lintels located in exterior walls.

D. Prime loose steel lintels located in exterior walls with zinc-rich primer.

## 2.11 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch (19-mm) bolts, spaced not more than 6 inches (150 mm) from ends and 24 inches (600 mm) o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches (50 mm) larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize shelf angles located in exterior walls.

D. Prime shelf angles located in exterior walls with zinc-rich primer.

E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

## 2.12 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates after fabrication.

C. Prime plates with zinc-rich primer.

## 2.13 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

## 2.14 STRUCTURAL-STEEL DOOR FRAMES

A. Fabricate structural-steel door frames from steel shapes, plates, and bars of size and to dimensions indicated, fully welded together, with 5/8-by-1-1/2-inch (16-by-38-mm) steel channel stops, unless otherwise indicated. Plug-weld built-up members and continuously weld exposed joints. Secure removable stops to frame with countersunk machine screws, uniformly spaced at not more than 10 inches (250 mm) o.c. Reinforce frames and drill and tap as necessary to accept finish hardware.

1. Provide with integrally welded steel strap anchors for securing door frames into adjoining concrete or masonry.

B. Extend bottom of frames to floor elevation indicated with steel angle clips welded to frames for anchoring frame to floor with expansion shields and bolts.

C. Galvanize [**exterior steel frames**] [**and**] [**interior steel frames, where indicated**].

D. Prime [**exterior steel frames**] [**and**] [**interior steel frames, where indicated**] with zinc-rich primer.

## 2.15 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize [**exterior miscellaneous steel trim**] [**and**] [**interior miscellaneous steel trim, where indicated**].

D. Prime [**exterior miscellaneous steel trim**] [**and**] [**interior miscellaneous steel trim, where indicated**] with zinc-rich primer.

## 2.16 METAL LADDERS

A. General:

1. Comply with ANSI A14.3, unless otherwise indicated.
2. For elevator pit ladders, comply with ASME A17.1.
3. Space siderails [**16 inches (406 mm)**] [**18 inches (457 mm)**] apart, unless otherwise indicated.
4. Support each ladder[ **at top and bottom and not more than 60 inches (1500 mm) o.c.**] with welded or bolted brackets, made from same metal as ladder.

B. Steel Ladders:

1. Siderails: Continuous, [**3/8-by-2-1/2-inch (9.5-by-64-mm)**] [**1/2-by-2-1/2-inch (12.7-by-64-mm)**] steel flat bars, with eased edges.
2. Rungs: [**3/4-inch- (19-mm-) diameter**] [**3/4-inch- (19-mm-) square**] [**1-inch- (25-mm-) diameter**] [**1-inch- (25-mm-) square**] steel bars.
3. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
4. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
5. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung by a proprietary process.
6. [**Available** ]Products:

    a. IKG Industries, a Harsco company; Mebac.
    b. W. S. Molnar Company; SlipNOT.
    c. <**Insert manufacturer's name; product name or designation.**>

7. Galvanize [**exterior ladders**] [**and**] [**interior ladders, where indicated**], including brackets and fasteners.
8. Prime [**exterior ladders**] [**and**] [**interior ladders, where indicated**], including brackets and fasteners, with zinc-rich primer.

C. Aluminum Ladders:

1. Siderails: Continuous extruded-aluminum channels or tubes, not less than 2-1/2 inches (64 mm) deep, 3/4 inch (19 mm) wide, and 1/8 inch (3.2 mm) thick.
2. Rungs: Extruded-aluminum tubes, not less than 3/4 inch (19 mm) deep and not less than 1/8 inch (3.2 mm) thick, with ribbed tread surfaces.
3. Fit rungs in centerline of siderails; fasten by welding or with stainless-steel fasteners or brackets and aluminum rivets.

## 2.17 LADDER SAFETY CAGES

A. General:

1. Fabricate ladder safety cages to comply with ANSI A14.3. Assemble by welding or with stainless-steel fasteners.
2. Provide primary hoops at tops and bottoms of cages and spaced not more than 20 feet (6 m) o.c. Provide secondary intermediate hoops spaced not more than 48 inches (1200 mm) o.c. between primary hoops.
3. Fasten assembled safety cage to ladder rails and adjacent construction by welding or with stainless-steel fasteners, unless otherwise indicated.

B. Steel Ladder Safety Cages:

1. Primary Hoops: 1/4-by-4-inch (6.4-by-100-mm) flat bar hoops.
2. Secondary Intermediate Hoops: 1/4-by-2-inch (6.4-by-50-mm) flat bar hoops.
3. Vertical Bars: 3/16-by-1-1/2-inch (4.8-by-38-mm) flat bars secured to each hoop.
4. Galvanize [**exterior ladder cages**] [**and**] [**interior ladder cages, where indicated**], including fasteners.

5. Prime [**exterior ladder cages**] [**and**] [**interior ladder cages, where indicated**], including fasteners, with zinc-rich primer.

C. Aluminum Ladder Safety Cages:

1. Primary Hoops: 1/4-by-4-inch (6.4-by-100-mm) flat bar hoops.
2. Secondary Intermediate Hoops: 1/4-by-2-inch (6.4-by-50-mm) flat bar hoops.
3. Vertical Bars: 1/4-by-2-inch (6.4-by-50-mm) flat bars secured to each hoop.

## 2.18 METAL SHIPS' LADDERS

A. Provide metal ships' ladders where indicated. Fabricate of open-type construction with channel or plate stringers, pipe and tube railings, and bar grating treads, unless otherwise indicated. Provide brackets and fittings for installation.

1. Fabricate ships' ladders, including treads and railings from [**steel**] [**aluminum**] [**stainless steel**].
2. Comply with applicable requirements in Division 5 Section "[**Metal Stairs**] [**Pipe and Tube Railings**]" for railings.

B. Galvanize [**exterior steel ships' ladders**] [**and**] [**interior steel ships' ladders, where indicated**], including treads, railings, brackets, and fasteners.

C. Prime [**exterior steel ships' ladders**] [**and**] [**interior steel ships' ladders, where indicated**], including treads, railings, brackets, and fasteners, with zinc-rich primer.

## 2.19 METAL BOLLARDS

A. Fabricate metal bollards from [**Schedule 40 steel pipe**] [**Schedule 80 steel pipe**] [**1/4-inch (6.4-mm) wall-thickness rectangular steel tubing**] [**steel shapes, as indicated**].

1. Cap bollards with 1/4-inch- (6.4-mm-) thick steel plate.
2. Where bollards are indicated to receive push-button controls for door operators, provide necessary cutouts for push-button controls and hole for wire.

B. Fabricate bollards with 3/8-inch- (9.5-mm-) thick steel baseplates for bolting to concrete slab. Drill baseplates at all 4 corners for 3/4-inch (19-mm) anchor bolts.

1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.

C. Fabricate sleeves for bollard anchorage from steel [**pipe**] [**or**] [**tubing**] with 1/4-inch- (6.4-mm-) thick steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches (200 mm) deep and 3/4 inch (19 mm) larger than OD of bollard.

D. Fabricate internal sleeves for removable bollards from Schedule 40 steel pipe or 1/4-inch (6.4-mm) wall-thickness steel tubing with an OD approximately 1/16 inch (1.5 mm) less than ID of bollards. Match drill sleeve and bollard for 3/4 inch (19 mm) steel machine bolt.

## 2.20 PIPE GUARDS

A. Fabricate pipe guards from 3/8-inch- (9.5-mm-) thick by 12-inch- (300-mm-) wide steel plate, bent to fit flat against the wall or column at both ends and to fit around pipe with 2-inch (50-mm) clearance between pipe and pipe guard. Drill each end for two 3/4-inch (19-mm) anchor bolts.

B. Galvanize pipe guards after fabrication.

## 2.21 BICYCLE RACKS

A. Fabricate from Schedule 40 steel pipe, fully welded together, to lengths indicated.

B. Fabricate with NPS 3 (DN 80) top rails and end posts, NPS 1-1/2 (DN 40) bottom rails[ **and intermediate posts not more than 72 inches (1800 mm) o.c.**], and NPS 3/4 (DN 20) vertical separators at approximately 8 inches (200 mm) o.c.

C. Make top rails 36 inches (900 mm) above pavement/floor and bottom rails 4 inches (100 mm) above pavement/floor.

D. Fabricate end posts[ **and intermediate posts**] with 1/4-inch- (6.4-mm-) thick steel baseplates for bolting to concrete slab. Drill end post baseplates at all 4 corners[ **and intermediate-post baseplates at 2 opposite sides**] for 1/2-inch (12.7-mm) anchor bolts.

E. Galvanize bicycle racks after fabrication.

F. Prime bicycle racks with zinc-rich primer.

## 2.22 METAL FLOOR PLATE

A. Fabricate from [**rolled-steel floor**] [**rolled-stainless-steel floor**] [**rolled-aluminum-alloy tread**] [**abrasive-surface floor**] plate of thickness indicated below:

1. Thickness: [**1/8 inch (3.2 mm)**] [**3/16 inch (4.8 mm)**] [**1/4 inch (6.4 mm)**] [**5/16 inch (8 mm)**] [**3/8 inch (9.5 mm)**] [**As indicated**].

B. Provide [**steel**] [**stainless-steel**] [**aluminum**] angle supports as indicated.

C. Include [**steel**] [**stainless-steel**] [**aluminum**] angle stiffeners, and fixed and removable sections as indicated.

D. Provide flush [**steel**] [**stainless-steel**] [**aluminum**] bar drop handles for lifting removable sections, one at each end of each section.

## 2.23 ABRASIVE METAL [**NOSINGS**] [**TREADS**] [**AND**] [**THRESHOLDS**]

A. Cast-Metal Units: Cast [**gray iron, Class 20**] [**aluminum**] [**bronze (leaded red or semired brass)**] [**nickel silver (leaded nickel bronze)**], with an integral abrasive finish consisting of

aluminum oxide, silicon carbide, or a combination of both. Fabricate units in sizes and configurations indicated and in lengths necessary to accurately fit openings or conditions.

1. [**Available** ]Manufacturers:

    a. American Safety Tread Co., Inc.
    b. Balco Inc.
    c. Barry Pattern & Foundry Co., Inc.
    d. Granite State Casting Co.
    e. Safe-T-Metal Co.
    f. Wooster Products Inc.
    g. <**Insert manufacturer's name.**>

2. Nosings: Cross-hatched units, 4 inches (100 mm) wide with [**1/4-inch (6-mm)**] [**1-inch (25-mm)**] lip, for casting into concrete steps.
3. Nosings: Cross-hatched units, 1-1/2 by 1-1/2 inches (38 by 38 mm), for casting into concrete curbs.
4. Treads: Cross-hatched units, full depth of tread with 3/4-by-3/4-inch (19-by-19-mm) nosing, for application over bent plate treads or existing stairs.
5. Thresholds: Fluted-saddle-type units, 5 inches (125 mm) wide by 1/2 inch (12 mm) high, with tapered edges.
6. Thresholds: Fluted-interlocking- (hook-strip-) type units, 5 inches (125 mm) wide by 5/8 inch (16 mm) high, with tapered edge.
7. Thresholds: Plain-stepped- (stop-) type units, 5 inches (125 mm) wide by 1/2 inch (12 mm) high, with 1/2-inch (12-mm) step.

B. Extruded Units: [**Aluminum**] [**Bronze**], with abrasive filler consisting of aluminum oxide, silicon carbide, or a combination of both, in an epoxy-resin binder. Fabricate units in sizes and configurations indicated and in lengths necessary to accurately fit openings or conditions.

1. [**Available** ]Manufacturers:

    a. ACL Industries, Inc.
    b. American Safety Tread Co., Inc.
    c. Amstep Products.
    d. Armstrong Products, Inc.
    e. Balco Inc.
    f. Granite State Casting Co.
    g. Wooster Products Inc.
    h. <**Insert manufacturer's name.**>

2. Provide ribbed units, with abrasive filler strips projecting 1/16 inch (1.5 mm) above aluminum extrusion.
3. Provide solid-abrasive-type units without ribs.
4. Nosings: Square-back units, [**1-7/8 inches (48 mm)**] [**3 inches (75 mm)**] [**4 inches (100 mm)**] wide, for casting into concrete steps.
5. Nosings: Beveled-back units, [**3 inches (75 mm)**] [**4 inches (100 mm)**] wide with 1-3/8-inch (35-mm) lip, for surface mounting on existing stairs.
6. Nosings: Two-piece units, 3 inches (75 mm) wide, with subchannel for casting into concrete steps.

7. Treads: [**Square**] [**Beveled**]-back units, full depth of tread with 1-3/8-inch (35-mm) lip, for application over existing stairs.

C. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.

D. Drill for mechanical anchors and countersink. Locate not more than 4 inches (100 mm) from ends and not more than 12 inches (300 mm) o.c., evenly spaced between ends, unless otherwise indicated. Provide closer spacing if recommended by manufacturer.

1. Provide 2 rows of holes for units more than 5 inches (125 mm) wide, with 2 holes aligned at ends and intermediate holes staggered.

E. Apply bituminous paint to concealed bottoms, sides, and edges of cast-metal units set into concrete.

F. Apply clear lacquer to concealed bottoms, sides, and edges of extruded units set into concrete.

## 2.24 CAST-IRON WHEEL GUARDS

A. Provide wheel guards of 3/4-inch- (19-mm-) thick, hollow-core, gray-iron castings; of size and shape indicated. Provide holes for countersunk anchor bolts and grouting.

## 2.25 METAL DOWNSPOUT BOOTS

A. Provide downspout boots made from [**cast gray iron**] [**cast aluminum**] in heights indicated with inlets of size and shape to suit downspouts.

1. Outlet: [**Vertical, to discharge into pipe**] [**Horizontal, to discharge into pipe**] [**At 35 degrees from horizontal, to discharge onto splash block or pavement**].

## 2.26 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

## 2.27 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123/A 123M, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B)[ **and Items Indicated to Receive Zinc-Rich Primer**]: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

## 2.28 STAINLESS-STEEL FINISHES

A. Remove tool and die marks and stretch lines or blend into finish.

B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

C. Bright, Directional Satin Finish: No. 4.

D. Dull Satin Finish: No. 6.

E. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

## 2.29 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

## 2.30 COPPER-ALLOY FINISHES

A. Finish designations for copper alloys comply with the system established for designating copper-alloy finish systems defined in NAAMM's "Metal Finishes Manual for Architectural and Metal Products."

B. Cast-[**Bronze**] [**Nickel Silver**] Finish: M12 (Mechanical Finish: matte finish, as fabricated).

C. Extruded-[**Bronze**] [**Nickel Silver**] Finish: M11 (Mechanical Finish: specular, as fabricated).

D. Bronze Plate, Sheet, Strip, and Bar Finish: M10 (Mechanical Finish: unspecified, as fabricated).

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

C. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

### 3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.

1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.

1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

## 3.3 INSTALLING PREFABRICATED BUILDING COLUMNS

A. Install prefabricated building columns to comply with AISC's "Specification for Structural Steel Buildings Allowable Stress Design and Plastic Design with Commentary" and with requirements applicable to listing and labeling for fire-resistance rating indicated.

## 3.4 INSTALLING BEARING AND LEVELING PLATES

A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.

1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

## 3.5 INSTALLING METAL BOLLARDS

A. Anchor bollards to existing construction with [**expansion anchors**] [**anchor bolts**] [**through bolts**]. Provide four 3/4-inch (19-mm) bolts at each bollard, unless otherwise indicated.

1. Embed anchor bolts at least 4 inches (100 mm) in concrete.

B. Anchor bollards in concrete [**with pipe sleeves preset and anchored into concrete**] [**in formed or core-drilled holes not less than 8 inches (200 mm) deep and 3/4 inch (19 mm) larger than OD of bollard**]. Fill annular space around bollard solidly with nonshrink, nonmetallic grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch (3 mm) toward bollard.

C. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches (75 mm) above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

D. Anchor internal sleeves for removable bollards in [**concrete by inserting into pipe sleeves preset into concrete**] [**formed or core-drilled holes not less than 8 inches (200 mm) deep and 3/4 inch (19 mm) larger than OD of sleeve**]. Fill annular space around internal sleeves

solidly with nonshrink, nonmetallic grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch (3 mm) toward internal sleeve.

E. Anchor internal sleeves for removable bollards in place with concrete footings. Center and align sleeves in holes 3 inches (75 mm) above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace sleeves in position until concrete has cured.

F. Place removable bollards over internal sleeves and secure with 3/4-inch (19-mm) machine bolts and nuts. After tightening nuts, drill holes in bolts for inserting padlocks. Owner will furnish padlocks.

G. Fill bollards solidly with concrete, mounding top surface to shed water.

1. Do not fill removable bollards with concrete.

## 3.6 INSTALLING PIPE GUARDS

A. Provide pipe guards at exposed vertical pipes in parking garage where not protected by curbs or other barriers. Install by bolting to wall or column with expansion anchors. Provide four 3/4-inch (19-mm) bolts at each pipe guard. Mount pipe guards with top edge 26 inches (660 mm) above driving surface.

## 3.7 INSTALLING BICYCLE RACKS

A. Anchor bicycle racks to existing construction with expansion anchors. Provide four 1/2-inch (12.7-mm) bolts at each end post[ **and 2 at each intermediate post**].

## 3.8 INSTALLING NOSINGS, TREADS, AND THRESHOLDS

A. Center nosings on tread widths.

B. For nosings embedded in concrete steps or curbs, align nosings flush with riser faces and level with tread surfaces.

C. Seal thresholds exposed to exterior with elastomeric sealant complying with Division 7 Section "Joint Sealants" to provide a watertight installation.

## 3.9 INSTALLING CAST-IRON WHEEL GUARDS

A. Anchor wheel guards to concrete or masonry construction to comply with manufacturer's written instructions. Fill cores solidly with concrete.

## 3.10 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 painting Sections.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05500

SECTION 05530 - GRATINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Metal bar gratings.
2. Expanded-metal gratings.
3. Formed-metal plank gratings.
4. Extruded-aluminum plank gratings.
5. Glass-fiber-reinforced plastic gratings.
6. Metal frames and supports for gratings.

B. Related Sections include the following:

1. Division 5 Section "Structural Steel" for structural-steel framing system components.
2. Division 5 Section "Metal Stairs" for grating treads and landings of steel-framed stairs.
3. Division 5 Section "Pipe and Tube Railings" for metal pipe and tube handrails and railings.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance of Gratings: Provide gratings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

1. Floors: Uniform load of [**75 lbf/sq. ft. (3.59 kN/sq. m)**] [**125 lbf/sq. ft. (6.00 kN/sq. m)**] or concentrated load of 2000 lbf (8.90 kN), whichever produces the greater stress.
2. Floors: Uniform load of [**125 lbf/sq. ft. (6.00 kN/sq. m)**] [**250 lbf/sq. ft. (11.97 kN/sq. m)**] or concentrated load of 3000 lbf (13.40 kN), whichever produces the greater stress.
3. Walkways and Elevated Platforms Other Than Exits: Uniform load of 60 lbf/sq. ft. (2.87 kN/sq. m).
4. Walkways and Elevated Platforms Used as Exits: Uniform load of 100 lbf/sq. ft. (4.79 kN/sq. m).
5. Sidewalks and Vehicular Driveways, Subject to Trucking: Uniform load of 250 lbf/sq. ft. (11.97 kN/sq. m) or concentrated load of 8000 lbf (35.60 kN), whichever produces the greater stress.
6. Limit deflection to [**L/240**] [**L/360**] <**Insert deflection ratio**> or 1/4 inch (6.4 mm), whichever is less.

B. Seismic Performance: Provide gratings capable of withstanding the effects of earthquake motions determined according to [**ASCE 7, "Minimum Design Loads for Buildings and Other Structures": Section 9, "Earthquake Loads."**] <**Insert applicable code requirement.**>

## 1.4 SUBMITTALS

A. Product Data: For the following:

1. Formed-metal plank gratings.
2. Extruded-aluminum plank gratings.
3. Glass-fiber-reinforced plastic gratings.
4. Clips and anchorage devices for gratings.
5. Paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Provide templates for anchors and bolts specified for installation under other Sections.
2. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.

D. Welding certificates.

E. Qualification Data: For professional engineer.

## 1.5 QUALITY ASSURANCE

A. Metal Bar Grating Standards: Comply with [**NAAMM MBG 531, "Metal Bar Grating Manual**][**" and**] [**NAAMM MBG 532, "Heavy-Duty Metal Bar Grating Manual**]."

B. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.2, "Structural Welding Code--Aluminum."
3. AWS D1.3, "Structural Welding Code--Sheet Steel."
4. AWS D1.6, "Structural Welding Code--Stainless Steel."

## 1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with gratings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating gratings without field

measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.

2. Provide allowance for trimming and fitting at site.

## 1.7 COORDINATION

A. Coordinate installation of anchorages for gratings, grating frames, and supports. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Metal Bar Gratings:

    a. Alabama Metal Industries Corporation.
    b. All American Grating, Inc.
    c. Barnett/Bates Corp.
    d. Borden Metal Products (Canada) Limited.
    e. Fisher & Ludlow.
    f. Grupo Metelmex, S.A. de C.V.
    g. IKG Industries; a Harsco Company.
    h. Marwas Steel Co.; Laurel Steel Products Division.
    i. Ohio Gratings, Inc.
    j. Seidelhuber Metal Products, Inc.
    k. Tru-Weld.
    l. <**Insert manufacturer's name.**>

2. Expanded-Metal Gratings:

    a. Alabama Metal Industries Corporation.
    b. All American Grating, Inc.
    c. Fisher & Ludlow.
    d. <**Insert manufacturer's name.**>

3. Formed-Metal Plank Gratings:

    a. Alabama Metal Industries Corporation.
    b. Fisher & Ludlow.
    c. GS Metals Corp.

d. IKG Industries; a Harsco Company.
e. Morton Manufacturing Company.
f. Unistrut Corporation.
g. <**Insert manufacturer's name.**>

4. Extruded-Aluminum Plank Gratings:

a. Alabama Metal Industries Corporation.
b. IKG Industries; a Harsco Company.
c. Ohio Gratings, Inc.
d. Seidelhuber Metal Products, Inc.
e. <**Insert manufacturer's name.**>

5. Glass-Fiber-Reinforced Plastic Gratings:

a. Creative Pultrusions, Inc.
b. Enduro Systems Inc.; Composite Products Division.
c. Fibergrate Composite Structures Inc.
d. Fisher & Ludlow.
e. IKG Industries; a Harsco Company.
f. Seasafe, Inc.
g. Strongwell.
h. <**Insert manufacturer's name.**>

## 2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Wire Rod for Grating Crossbars: ASTM A 510 (ASTM A 510M).

C. Uncoated Steel Sheet: ASTM A 1011/A 1011M, structural steel, Grade 30 (Grade 205).

D. Galvanized Steel Sheet: ASTM A 653/A 653M, structural quality, Grade 33 (Grade 230), with G90 (Z275) coating.

E. Expanded Metal, Carbon Steel: ASTM F 1267, Class 1.

F. Expanded Metal, Galvanized Steel: ASTM F 1267, Class 2, Grade A.

G. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type [**304**] [**316**].

H. Stainless-Steel Bars and Shapes: ASTM A 276, Type [**304**] [**316**].

I. Expanded Metal, Stainless Steel: ASTM F 1267, Class 3, made from stainless-steel sheet complying with ASTM A 666, Type [**304**] [**316**].

## 2.3 ALUMINUM

A. Aluminum, General: Provide alloy and temper recommended by aluminum producer for type of use indicated, and with not less than the strength and durability properties of alloy and temper designated below for each aluminum form required.

B. Extruded Bars and Shapes: ASTM B 221 (ASTM B 221M), alloys as follows:

1. 6061-T6 or 6063-T6, for bearing bars of gratings and shapes.
2. 6061-T1, for grating crossbars.

C. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 5052-H32.

## 2.4 FASTENERS

A. General: Unless otherwise indicated, provide Type [**304**] [**316**] stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts, and, where indicated, flat washers; ASTM F 593 (ASTM F 738M) for bolts and ASTM F 594 (ASTM F 836M) for nuts, Alloy Group [**1 (A1)**] [**2 (A4)**].

D. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).

E. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).

F. Anchors: Provide [**cast-in-place**] [**chemical**] [**or**] [**torque-controlled expansion**] anchors with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material for Anchors in Exterior Locations: Alloy Group [**1 (A1)**] [**2 (A4)**] stainless-steel bolts complying with ASTM F 593 (ASTM F 738M) and nuts complying with ASTM F 594 (ASTM F 836M).

## 2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy that is welded.

B. Shop Primers: Provide primers that comply with Division 9 [**painting Sections.**] [**Section "High-Performance Coatings."**]

C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.

1. Use primer with a VOC content of [**420 g/L (3.5 lb/gal.)**] <**Insert VOC limit**> or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. Zinc-Rich Primer: Zinc-rich primer, complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.

1. Use primer with a VOC content of [**420 g/L (3.5 lb/gal.)**] <**Insert VOC limit**> or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
3. Products: Subject to compliance with requirements, provide one of the following:

a. Benjamin Moore & Co.; Epoxy Zinc-Rich Primer CM18/19.
b. Carboline Company; Carbozinc 621.
c. ICI Devoe Coatings; Catha-Coat 313.
d. International Coatings Limited; Interzinc 315 Epoxy Zinc-Rich Primer.
e. PPG Architectural Finishes, Inc.; Aquapon Zinc-Rich Primer 97-670.
f. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.
g. Tnemec Company, Inc.; Tneme-Zinc 90-97.
h. <**Insert manufacturer's name; product name or designation.**>

E. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

## 2.6 FABRICATION

A. Shop Assembly: Fabricate grating sections in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

B. Cut, drill, and punch material cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

C. Form from materials of size, thickness, and shapes indicated, but not less than that needed to support indicated loads.

D. Fit exposed connections accurately together to form hairline joints.

E. Welding: Comply with AWS recommendations and the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

F. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space the anchoring devices to secure gratings, frames, and supports rigidly in place and to support indicated loads.

1. Fabricate toeplates to fit grating units and weld to units in shop, unless otherwise indicated.
2. Fabricate toeplates for attaching in the field.
3. Toeplate Height: 4 inches (100 mm), unless otherwise indicated.

## 2.7 METAL BAR GRATINGS

A. Welded Steel Grating [**WSBG-**<#>]:

1. Bearing Bar Spacing: [**7/16 or 1/2 inch (11 or 13 mm)**] [**11/16 inch (17 mm)**] [**15/16 inch (24 mm)**] [**1-3/16 inches (30 mm)**] [**1-3/8 inches (35 mm)**] [**1-7/8 inches (48 mm)**] [**2-3/8 inches (60 mm)**] <**Insert spacing**> o.c.
2. Bearing Bar Depth: [**3/4 inch (19 mm)**] [**1 inch (25 mm)**] [**1-1/4 inches (32 mm)**] [**1-1/2 inches (38 mm)**] [**1-3/4 inches (44 mm)**] [**2 inches (51 mm)**] [**2-1/4 inches (57 mm)**] [**2-1/2 inches (64 mm)**] [**3 inches (76 mm)**] [**3-1/2 inches (89 mm)**] [**4 inches (102 mm)**] [**4-1/2 inches (114 mm)**] [**5 inches (127 mm)**] [**As required to comply with structural performance requirements**].
3. Bearing Bar Thickness: [**1/8 inch (3.2 mm)**] [**3/16 inch (4.8 mm)**] [**1/4 inch (6.4 mm)**] [**3/8 inch (9.5 mm)**] [**As required to comply with structural performance requirements**].
4. Crossbar Spacing: [**2 inches (51 mm)**] [**4 inches (102 mm)**] o.c.
5. Grating Mark W-11-4 (1 x 3/16) STEEL: 1-by-3/16-inch (25-by-4.8-mm) bearing bars at 11/16 inch (18 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
6. Grating Mark W-15-4 (1 x 1/8) STEEL: 1-by-1/8-inch (25-by-3.2-mm) bearing bars at 15/16 inch (24 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
7. Grating Mark W-19-4 (1-1/4 x 3/16) STEEL: 1-1/4-by-3/16-inch (32-by-4.8-mm) bearing bars at 1-3/16 inches (30 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
8. Grating Mark W-19-4 (1-1/2 x 3/16) STEEL: 1-1/2-by-3/16-inch (38-by-4.8-mm) bearing bars at 1-3/16 inches (30 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
9. Grating Mark W-19-4 (2 x 1/4) STEEL: 2-by-1/4-inch (51-by-6.4-mm) bearing bars at 1-3/16 inches (30 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
10. Grating Mark W-30-4 (5 x 3/8) STEEL: 5-by-3/8-inch (127-by-9.5-mm) bearing bars at 1-7/8 inches (60 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
11. Grating Mark: As indicated.
12. Traffic Surface: [**Plain**] [**Serrated**] [**Knurled**] [**Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy-resin adhesive**] [**As indicated**].
13. Steel Finish: [**Shop primed**] [**Hot-dip galvanized with a coating weight of not less than 1.8 oz./sq. ft. (550 g/sq. m) of coated surface**].

B. Pressure-Locked Steel Grating [**PSBG-**<#>]: Fabricated by [**pressing rectangular flush-top crossbars into slotted bearing bars**] [**swaging crossbars between bearing bars**] [**either pressing rectangular flush-top crossbars into slotted bearing bars or swaging crossbars between bearing bars**].

1. Bearing Bar Spacing: [**7/16 or 1/2 inch (11 or 13 mm)**] [**11/16 inch (17 mm)**] [**15/16 inch (24 mm)**] [**1-3/16 inches (30 mm)**] <**Insert spacing**> o.c.
2. Bearing Bar Depth: [**3/4 inch (19 mm)**] [**1 inch (25 mm)**] [**1-1/4 inches (32 mm)**] [**1-1/2 inches (38 mm)**] [**1-3/4 inches (44 mm)**] [**2 inches (51 mm)**] [**2-1/4 inches (57 mm)**] [**2-1/2 inches (64 mm)**] [**As required to comply with structural performance requirements**] <**Insert depth**>.
3. Bearing Bar Thickness: [**1/8 inch (3.2 mm)**] [**3/16 inch (4.8 mm)**] [**As required to comply with structural performance requirements**] <**Insert thickness**>.
4. Crossbar Spacing: [**2 inches (51 mm)**] [**4 inches (102 mm)**] o.c.
5. Grating Mark P-11-4 (1 x 3/16) STEEL: 1-by-3/16-inch (25-by-4.8-mm) bearing bars at 11/16 inch (18 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
6. Grating Mark P-15-4 (1-1/4 x 1/8) STEEL: 1-1/4-by-1/8-inch (32-by-3.2-mm) bearing bars at 15/16 inch (24 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
7. Grating Mark P-19-4 (1-1/2 x 3/16) STEEL: 1-1/2-by-3/16-inch (38-by-4.8-mm) bearing bars at 1-3/16 inches (30 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
8. Grating Mark: As indicated.
9. Traffic Surface: [**Plain**] [**Serrated**] [**Knurled**] [**Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy-resin adhesive**] [**As indicated**].
10. Steel Finish: [**Shop primed**] [**Hot-dip galvanized with a coating weight of not less than 1.8 oz./sq. ft. (550 g/sq. m) of coated surface**].

C. Riveted Steel Grating [**RSBG-**<#>]:

1. Bearing Bar Spacing: [**3/4 inch (19 mm)**] [**1-1/8 inches (29 mm)**] [**2-5/16 inches (59 mm)**] <**Insert spacing**>, clear.
2. Bearing Bar Depth: [**3/4 inch (19 mm)**] [**1 inch (25 mm)**] [**1-1/4 inches (32 mm)**] [**1-1/2 inches (38 mm)**] [**1-3/4 inches (44 mm)**] [**2 inches (51 mm)**] [**2-1/4 inches (57 mm)**] [**2-1/2 inches (64 mm)**] [**3 inches (76 mm)**] [**3-1/2 inches (89 mm)**] [**4 inches (102 mm)**] [**4-1/2 inches (114 mm)**] [**5 inches (127 mm)**] [**As required to comply with structural performance requirements**].
3. Bearing Bar Thickness: [**1/8 inch (3.2 mm)**] [**3/16 inch (4.8 mm)**] [**1/4 inch (6.4 mm)**] [**3/8 inch (9.5 mm)**] [**As required to comply with structural performance requirements**].
4. Rivet Spacing: [**3-1/2 inches (89 mm)**] [**5 inches (127 mm)**] [**7 inches (178 mm)**] o.c. along bearing bar.
5. Grating Mark R-12-3-1/2 (1 x 1/8) STEEL: 1-by-1/8-inch (25-by-3.2-mm) bearing bars with 3/4-inch (19-mm) clear space between bearing bars, and rivets at 3-1/2 inches (89 mm) o.c. along bearing bar.
6. Grating Mark R-18-7 (1-1/2 x 3/16) STEEL: 1-1/2-by-3/16-inch (38-by-4.8-mm) bearing bars with 1-1/8-inch (29-mm) clear space between bearing bars, and rivets at 7 inches (178 mm) o.c. along bearing bar.
7. Grating Mark R-37-5 (4 x 1/4) STEEL: 4-by-1/4-inch (102-by-6.4-mm) bearing bars with 2-5/16-inch (59-mm) clear space between bearing bars, and rivets at 5 inches (127 mm) o.c. along bearing bar.
8. Grating Mark R-37-5 (5 x 3/8) STEEL: 5-by-3/8-inch (127-by-9.5-mm) bearing bars with 2-5/16-inch (59-mm) clear space between bearing bars, and rivets at 5 inches (127 mm) o.c. along bearing bar.
9. Grating Mark: As indicated.
10. Traffic Surface: [**Plain**] [**Serrated**] [**Knurled**] [**Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy-resin adhesive**] [**As indicated**].

11. Steel Finish: [**Shop primed**] [**Hot-dip galvanized with a coating weight of not less than 1.8 oz./sq. ft. (550 g/sq. m) of coated surface**].

D. Pressure-Locked, Stainless-Steel Grating [**PSSBG-**<#>]: Fabricated by [**pressing rectangular flush-top crossbars into slotted bearing bars**] [**swaging crossbars between bearing bars**] [**either pressing rectangular flush-top crossbars into slotted bearing bars or swaging crossbars between bearing bars**].

1. Bearing Bar Spacing: [**7/16 or 1/2 inch (11 or 13 mm)**] [**11/16 inch (17 mm)**] [**15/16 inch (24 mm)**] [**1-3/16 inches (30 mm)**] [**1-3/8 inches (35 mm)**] [**1-7/8 inches (48 mm)**] [**2-3/8 inches (60 mm)**] <**Insert spacing**> o.c.
2. Bearing Bar Depth: [**3/4 inch (19 mm)**] [**1 inch (25 mm)**] [**1-1/4 inches (32 mm)**] [**1-1/2 inches (38 mm)**] [**1-3/4 inches (44 mm)**] [**2 inches (51 mm)**] [**2-1/4 inches (57 mm)**] [**2-1/2 inches (64 mm)**] [**3 inches (76 mm)**] [**3-1/2 inches (89 mm)**] [**4 inches (102 mm)**] [**4-1/2 inches (114 mm)**] [**5 inches (127 mm)**] [**As required to comply with structural performance requirements**].
3. Bearing Bar Thickness: [**1/8 inch (3.2 mm)**] [**3/16 inch (4.8 mm)**] [**1/4 inch (6.4 mm)**] [**3/8 inch (9.5 mm)**] [**As required to comply with structural performance requirements**].
4. Crossbar Spacing: [**2 inches (51 mm)**] [**4 inches (102 mm)**] o.c.
5. Grating Mark P-11-4 (1 x 3/16) STAINLESS STEEL: 1-by-3/16-inch (25-by-4.8-mm) bearing bars at 11/16 inch (18 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
6. Grating Mark P-15-2 (1 x 1/8) STAINLESS STEEL: 1-by-1/8-inch (25-by-3.2-mm) bearing bars at 15/16 inch (24 mm) o.c., and crossbars at 2 inches (51 mm) o.c.
7. Grating Mark P-19-4 (1-1/2 x 3/16) STAINLESS STEEL: 1-1/2-by-3/16-inch (38-by-4.8-mm) bearing bars at 1-3/16 inches (30 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
8. Grating Mark P-30-4 (3 x 3/8) STAINLESS STEEL: 3-by-3/8-inch (76-by-9.5-mm) bearing bars at 1-7/8 inches (48 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
9. Grating Mark: As indicated.
10. Traffic Surface: [**Plain**] [**Serrated**] [**Knurled**] [**Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy-resin adhesive**] [**As indicated**].
11. Finish: [**Mill finish**] [**Abrasive blasted**] [**Electropolished**].

E. Pressure-Locked, Rectangular Bar Aluminum Grating [**PABG-**<#>]: Fabricated by [**pressing rectangular flush-top crossbars into slotted bearing bars**] [**swaging crossbars between bearing bars**] [**either pressing rectangular flush-top crossbars into slotted bearing bars or swaging crossbars between bearing bars**].

1. Bearing Bar Spacing: [**7/16 or 1/2 inch (11 or 13 mm)**] [**11/16 inch (17.5 mm)**] [**15/16 inch (24 mm)**] [**1-3/16 inches (30 mm)**] <**Insert spacing**> o.c.
2. Bearing Bar Depth: [**1 inch (25 mm)**] [**1-1/4 inches (32 mm)**] [**1-1/2 inches (38 mm)**] [**1-3/4 inches (44 mm)**] [**2 inches (51 mm)**] [**2-1/4 inches (57 mm)**] [**2-1/2 inches (64 mm)**] [**As required to comply with structural performance requirements**].
3. Bearing Bar Thickness: [**1/8 inch (3.2 mm)**] [**3/16 inch (4.8 mm)**] [**1/4 inch (6.4 mm)**] [**As required to comply with structural performance requirements**].
4. Crossbar Spacing: [**2 inches (51 mm)**] [**4 inches (102 mm)**] o.c.
5. Grating Mark P-7-4 (1 x 1/8) ALUMINUM: 1-by-1/8-inch (25-by-3.2-mm) bearing bars at 7/16 inch (11 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
6. Grating Mark P-11-4 (1 x 3/16) ALUMINUM: 1-by-3/16-inch (25-by-4.8-mm) bearing bars at 11/16 inch (18 mm) o.c., and crossbars at 4 inches (102 mm) o.c.

7. Grating Mark P-15-4 (1-1/2 x 3/16) ALUMINUM: 1-1/2-by-3/16-inch (38-by-4.8-mm) bearing bars at 15/16 inch (24 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
8. Grating Mark P-19-4 (2 x 3/16) ALUMINUM: 2-by-3/16-inch (51-by-4.8-mm) bearing bars at 1-3/16 inches (30 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
9. Grating Mark: As indicated.
10. Traffic Surface: [**Plain**] [**Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy-resin adhesive**] [**As indicated**].
11. Aluminum Finish: [**Mill finish**] [**Class I, clear, anodized finish**].

F. Pressure-Locked, I-Bar Aluminum Grating [**PAIBG-**<#>]: Fabricated by swaging crossbars between bearing bars.

1. Bearing Bar Spacing: [**7/16 or 1/2 inch (11 or 13 mm)**] [**11/16 inch (17 mm)**] [**15/16 inch (24 mm)**] [**1-3/16 inches (30 mm)**] <**Insert spacing**> o.c.
2. Bearing Bar Depth: [**1 inch (25 mm)**] [**1-1/4 inches (32 mm)**] [**1-1/2 inches (38 mm)**] [**1-3/4 inches (44 mm)**] [**2 inches (51 mm)**] [**2-1/4 inches (57 mm)**] [**2-1/2 inches (64 mm)**] [**As required to comply with structural performance requirements**].
3. Bearing Bar Flange Width: 1/4 inch (6.4 mm).
4. Crossbar Spacing: [**2 inches (51 mm)**] [**4 inches (102 mm)**] o.c.
5. Grating Mark P-11-4 (1 I-Bar) ALUMINUM: 1-inch (25-mm) I-bar bearing bars at 11/16 inch (18 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
6. Grating Mark P-15-2 (1 I-Bar) ALUMINUM: 1-inch (25-mm) I-bar bearing bars at 15/16 inch (24 mm) o.c., and crossbars at 2 inches (51 mm) o.c.
7. Grating Mark P-19-4 (1-1/2 I-Bar) ALUMINUM: 1-1/2-inch (38-mm) I-bar bearing bars at 1-3/16 inches (30 mm) o.c., and crossbars at 4 inches (102 mm) o.c.
8. Grating Mark: As indicated.
9. Traffic Surface: [**Plain**] [**Grooved**] [**Applied abrasive finish consisting of aluminum-oxide aggregate in an epoxy-resin adhesive**] [**As indicated**].
10. Aluminum Finish: [**Mill finish**] [**Class I, clear, anodized finish**].

G. Removable Grating Sections: Fabricate with banding bars attached by welding to entire perimeter of each section. Include anchors and fasteners of type indicated or, if not indicated, as recommended by manufacturer for attaching to supports.

1. Provide not less than four weld lugs for each heavy-duty grating section, with each lug shop welded to two bearing bars.
2. Provide not less than 4 saddle clips for each grating section composed of rectangular bearing bars 3/16 inch (4.8 mm) or less in thickness and spaced 15/16 inch (24 mm) or more o.c., with each clip designed and fabricated to fit over 2 bearing bars.
3. Provide not less than 4 weld lugs for each grating section composed of rectangular bearing bars 3/16 inch (4.8 mm) or less in thickness and spaced less than 15/16 inch (24 mm) o.c., with each lug shop welded to 3 or more bearing bars. Interrupt intermediate bearing bars as necessary for fasteners securing grating to supports.
4. Provide not less than four flange blocks for each section of aluminum I-bar grating, with block designed to fit over lower flange of I-shaped bearing bars.
5. Furnish threaded bolts with nuts and washers for securing grating to supports.
6. Furnish self-drilling fasteners with washers for securing grating to supports.
7. Furnish galvanized malleable-iron flange clamp with galvanized bolt for securing grating to supports. Furnish as a system designed to be installed from above grating by one person.

a. Available Product: Subject to compliance with requirements, a product that may be incorporated into the Work includes, but is not limited to, "Grate-Fast" by Lindapter North America, Inc.
b. Product: Subject to compliance with requirements, provide "Grate-Fast" by Lindapter North America, Inc.

H. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.

1. Edge-band openings in grating that interrupt four or more bearing bars with bars of same size and material as bearing bars.

I. Do not notch bearing bars at supports to maintain elevation.

## 2.8 EXPANDED-METAL GRATINGS

A. Provide expanded-metal gratings in material, finish, style, size, thickness, weight, and type indicated or, if not indicated, as recommended by manufacturer for indicated applications and as needed to support indicated loads.

1. Material: [**Steel**] [**Stainless steel**] [**Aluminum**].
2. Steel Finish: [**Unfinished, oiled**] [**Shop primed**] [**Galvanized**].
3. Stainless-Steel Finish: Mill finish, as fabricated.
4. Aluminum Finish: Mill finish, as fabricated.
5. Style Designation: [**4.27 pound grating**] [**3/4 number 9**].
6. Type: [**I, expanded**] [**II, expanded and flattened**].

B. Fabricate cutouts in grating sections for penetrations of sizes and at locations indicated. Cut openings neatly and accurately to size. Edge-band openings with bars having a thickness not less than overall grating thickness at contact points.

C. Where gratings are pierced by pipes, ducts, and structural members, cut openings neatly and accurately to size and weld a strap collar not less than 1/8 inch (3 mm) thick to the cut ends. Divide panels into sections only to extent required for installation where grating platforms and runways are to be placed around previously installed pipe, ducts, and structural members.

## 2.9 FORMED-METAL PLANK GRATINGS

A. C-shaped channels rolled from heavy sheet metal of thickness indicated, and punched in serrated diamond shape to produce raised slip-resistant surface and drainage holes.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Alabama Metal Industries Corporation; Diamond Grip.
b. Fisher & Ludlow; Grip Span.
c. GS Metals Corp.; GRIP STRUT.
d. IKG Industries, a Harsco Company; Deck Span.

e. Morton Manufacturing Company; Grip-Tac.
f. <**Insert manufacturer's name; product name or designation.**>

3. Channel Width: [**4-3/4 inches (121 mm)**] [**7 inches (178 mm)**] [**9-1/2 inches (241 mm)**] [**11-3/4 inches (298 mm)**] [**18-3/4 inches (476 mm)**] [**24 inches (610 mm)**] [**As indicated**] [**As required to comply with structural performance requirements**].
4. Channel Depth: [**1-1/2 inches (38 mm)**] [**2 inches (51 mm)**] [**2-1/2 inches (64 mm)**] [**3 inches (76 mm)**] [**As indicated**] [**As required to comply with structural performance requirements**].
5. Material: [**0.074-inch- (1.9-mm-) thick steel sheet, shop primed**] [**0.104-inch- (2.65-mm-) thick steel sheet, shop primed**] [**0.079-inch- (2.0-mm-) thick, hot-dip galvanized steel sheet**] [**0.108-inch- (2.8-mm-) thick, hot-dip galvanized steel sheet**] [**0.074-inch- (1.9-mm-) thick steel sheet, hot-dip galvanized after fabrication**] [**0.104-inch- (2.65-mm-) thick steel sheet, hot-dip galvanized after fabrication**] [**0.062-inch- (1.6-mm-) thick, stainless-steel sheet**] [**0.078-inch- (2.0-mm-) thick, stainless-steel sheet**] [**0.080-inch- (2.0-mm-) thick aluminum sheet**] [**0.100-inch- (2.5-mm-) thick aluminum sheet**].

B. Fabricate cutouts in grating sections for penetrations of sizes and at locations indicated. Cut openings neatly and accurately to size. Edge-band openings with metal sheet or bars having a thickness not less than grating material.

C. Where gratings are pierced by pipes, ducts, and structural members, cut openings neatly and accurately to size and weld a strap collar not less than 1/8 inch (3 mm) thick to the cut ends. Divide panels into sections only to extent required for installation where grating platforms and runways are to be placed around previously installed pipe, ducts, and structural members.

## 2.10 EXTRUDED-ALUMINUM PLANK GRATINGS

A. Provide extruded-aluminum plank gratings in type, size, and finish indicated or, if not indicated, as recommended by manufacturer for indicated applications and as needed to support indicated loads.

1. Type: Extruded-aluminum planks approximately 6 inches (152 mm) wide with multiple flanges approximately 1.2 inches (30 mm) o.c., acting as bearing bars connected by a web that serves as a walking surface. Top surface has raised ribs to increase slip resistance.
2. Depth: [**1 inch (25 mm)**] [**1-1/2 inches (38 mm)**] [**2 inches (51 mm)**] [**As required to comply with structural performance requirements**].
3. Perforations: [**None**] [**Rectangular, 19/32 by 3 inches (15 by 76 mm), with adjacent rows staggered**] [**19/32 inch (15 mm) square, with adjacent rows aligned**].
4. Finish: Mill finish, as fabricated.

B. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.

## 2.11 GLASS-FIBER-REINFORCED PLASTIC GRATINGS

A. Molded Glass-Fiber-Reinforced Gratings: Bar gratings made by placing glass-fiber strands that have been saturated with thermosetting plastic resin in molds in alternating directions to form interlocking bars without voids and with a high resin content.

1. Configuration: [**1-1/2-inch- (38-mm-) square mesh, 1 inch (25 mm) thick**] [**1-1/2-inch- (38-mm-) square mesh, 1-1/4 inches (32 mm) thick**] [**1-1/2-inch- (38-mm-) square mesh, 1-1/2 inches (38 mm) thick**] [**2-inch- (51-mm-) square mesh, 2 inches (51 mm) thick**] [**1-1/2-inch- (38-mm-) square mesh, thickness as required to comply with structural performance requirements**] [**As required to comply with structural performance requirements**] <**Insert configuration**>.
2. Weight: [**2.5 lb/sq. ft. (12.2 kg/sq. m)**] [**2.7 lb/sq. ft. (13.2 kg/sq. m)**] [**3.2 lb/sq. ft. (15.6 kg/sq. m)**] [**3.5 lb/sq. ft. (17.1 kg/sq. m)**] [**3.7 lb/sq. ft. (18.1 kg/sq. m)**] [**4.1 lb/sq. ft. (20.0 kg/sq. m)**] [**5.0 lb/sq. ft. (24.4 kg/sq. m)**] <**Insert weight**>.
3. Resin: [**Polyester**] [**Vinylester**] <**Insert description**>.
    a. Flame-Spread Index: 25 or less when tested according to ASTM E 84.
    b. U.S.D.A. Acceptance: Accepted for food-processing applications.
4. Color: [**Beige**] [**Gray**] [**Green**] [**Orange**] [**Yellow**] [**Manufacturer's standard**].
5. Traffic Surface: [**Plain, meniscus**] [**Applied abrasive finish**] [**As indicated**].

B. Pultruded Glass-Fiber-Reinforced Gratings: Bar gratings assembled from components made by simultaneously pulling glass fibers and extruding thermosetting plastic resin through a heated die under pressure to produce a product without voids and with a high glass-fiber content.

1. Configuration: [**I4010; 1-inch (25-mm) I-bars spaced 1 inch (25 mm) o.c. (40 percent open)**] [**I6010; 1-inch (25-mm) I-bars spaced 1-1/2 inches (38 mm) o.c. (60 percent open)**] [**I4015; 1-1/2-inch (38-mm) I-bars spaced 1 inch (25 mm) o.c. (40 percent open)**] [**I6015; 1-1/2-inch (38-mm) I-bars spaced 1-1/2 inches (38 mm) o.c. (60 percent open)**] [**T3320; 2-inch (51-mm) T-bars spaced 1-1/2 inches (38 mm) o.c. (33 percent open)**] [**T5020; 2-inch (51-mm) T-bars spaced 2 inches (51 mm) o.c. (50 percent open)**] [**As required to comply with structural performance requirements**] <**Insert configuration**>.
2. Weight: [**2.35 lb/sq. ft. (11.5 kg/sq. m)**] [**2.83 lb/sq. ft. (13.8 kg/sq. m)**] [**3.10 lb/sq. ft. (15.1 kg/sq. m)**] [**3.41 lb/sq. ft. (16.6 kg/sq. m)**] [**4.10 lb/sq. ft. (20.0 kg/sq. m)**] [**4.13 lb/sq. ft. (20.2 kg/sq. m)**] <**Insert weight**>.
3. Resin Type: [**Polyester**] [**Vinylester**] <**Insert description**>.
    a. Flame-Spread Index: 25 or less when tested according to ASTM E 84.
    b. U.S.D.A. Acceptance: Accepted for food processing applications.
4. Color: [**Beige**] [**Gray**] [**Green**] [**Orange**] [**Yellow**] [**Manufacturer's standard**].
5. Traffic Surface: [**Plain, grooved**] [**Applied abrasive finish**] [**As indicated**].

C. Fabricate cutouts in grating sections for penetrations indicated. Arrange cutouts to permit grating removal without disturbing items penetrating gratings.

## 2.12 GRATING FRAMES AND SUPPORTS

A. Frames and Supports for Metal Gratings: Fabricate from metal shapes, plates, and bars of welded construction to sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter and weld connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.

1. Unless otherwise indicated, fabricate from same basic metal as gratings.
2. Equip units indicated to be cast into concrete or built into masonry with integrally welded anchors. Unless otherwise indicated, space anchors 24 inches (600 mm) o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inches (32 mm) wide by 1/4 inch (6 mm) thick by 8 inches (200 mm) long.

B. Frames and Supports for Glass-Fiber-Reinforced Plastic Gratings: Fabricate from glass-fiber-reinforced plastic shapes of sizes, shapes, and profiles indicated and as necessary to receive gratings. Miter connections for perimeter angle frames. Cut, drill, and tap units to receive hardware and similar items.

1. Unless otherwise indicated, use shapes made from same resin as gratings.
2. Equip units indicated to be cast into concrete or built into masonry with integral anchors.

C. Galvanize steel frames and supports in the following locations:

1. Exterior.
2. Interior, where indicated.

## 2.13 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

## 2.14 STEEL FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish gratings, frames, and supports after assembly.

C. Galvanizing: For those items indicated for galvanizing, apply zinc coating by the hot-dip process complying with ASTM A 123/A 123M.

D. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Exteriors (SSPC Zone 1B)[ **and Items Indicated to Receive Zinc-Rich Primer**]: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."

E. Apply shop primer to uncoated surfaces of gratings, frames, and supports, except those with galvanized finishes and those to be embedded in concrete or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing gratings. Set units accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.

D. Fit exposed connections accurately together to form hairline joints.

1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade the surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.

E. Attach toeplates to gratings by welding at locations indicated.

F. Field Welding: Comply with the following requirements:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.

G. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

### 3.2 INSTALLING METAL BAR GRATINGS

A. General: Install gratings to comply with recommendations of referenced metal bar grating standards that apply to grating types and bar sizes indicated, including installation clearances and standard anchoring details.

B. Attach removable units to supporting members with type and size of clips and fasteners indicated or, if not indicated, as recommended by grating manufacturer for type of installation conditions shown.

C. Attach nonremovable units to supporting members by welding where both materials are same; otherwise, fasten by bolting as indicated above.

## 3.3 INSTALLING EXPANDED-METAL GRATINGS

A. General: Comply with manufacturer's written instructions for installing gratings.

B. Place units with straight edge of bond up and with long direction of diamond-shaped openings parallel to direction of span.

C. Attach removable units to supporting members by bolting at 6-inch (150-mm) intervals.

D. Attach nonremovable units to supporting members by welding, unless otherwise indicated. Space welds at 6-inch (150-mm) intervals.

E. Attach aluminum units to steel supporting members by bolting at 6-inch (150-mm) intervals.

F. Butt edges parallel to long direction of diamond-shaped openings and weld at every second bond point. Place individual grating sections so diamonds of one piece are aligned with those of adjacent sections.

## 3.4 INSTALLING METAL PLANK GRATINGS

A. General: Comply with manufacturer's written instructions for installing gratings. Use manufacturer's standard anchor clips and hold-down devices for bolted connections.

B. Attach removable units to supporting members by bolting at every point of contact.

C. Attach nonremovable units to supporting members by welding, unless otherwise indicated. Comply with manufacturer's written instructions for size and spacing of welds.

D. Attach aluminum units to steel supporting members by bolting at side channels at every point of contact and by bolting intermediate planks at each end on alternate sides. Bolt adjacent planks together at midspan.

## 3.5 INSTALLING GLASS-FIBER-REINFORCED PLASTIC GRATINGS

A. Comply with manufacturer's written instructions for installing gratings. Use manufacturer's standard stainless-steel anchor clips and hold-down devices for bolted connections.

## 3.6 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 painting Sections.

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05530

# Division 6 - Woods and Plastics

SECTION 06610

FIBERGLASS REINFORCED PLASTICS (FRP) FABRICATIONS

PULTRUDED INDUSTRIAL GRATING

## PART 1 - GENERAL

### 1.1 SCOPE OF WORK

A. The CONTRACTOR shall furnish, fabricate (where necessary), and install all fiberglass reinforced plastic (FRP) items, with all appurtenances, accessories and incidentals necessary to produce a complete, operable and serviceable installation as shown on the Contract Drawings and as specified herein, and in accordance with the requirements of the Contract Documents.

### 1.2 REFERENCES

A. The publications listed below (latest revision applicable) form a part of this specification to the extent referenced herein. The publications are referred to within the text by the designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) Test Methods:

ASTM D 635 Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position

ASTM D 732 Shear Strength of Plastics by Punch Tool

ASTM E 84 Surface Burning Characteristics of Building Materials

### 1.3 CONTRACTOR SUBMITTALS

A. The CONTRACTOR shall furnish shop drawings of all fabricated gratings and accessories in accordance with the provisions of this Section.

B. The CONTRACTOR shall furnish manufacturer's shop drawings clearly showing material sizes, types, styles, part or catalog numbers, complete details for the fabrication of and erection of components including, but not limited to, location, lengths, type and sizes of fasteners, clip angles, member sizes, and connection details.

C. The CONTRACTOR shall submit the manufacturer’s published literature including structural design data, structural properties data, grating load/deflection tables, corrosion resistance tables, certificates of compliance, test reports as applicable, concrete anchor systems and their allowable load tables, and design calculations for systems not sized or designed in the contract documents.

D. The CONTRACTOR shall submit sample pieces of each item specified herein for acceptance by the ENGINEER as to quality and color. Sample pieces shall be manufactured by the method to be used in the WORK.

1.4 QUALITY ASSURANCE

A. All items to be provided under this Section shall be furnished only by manufacturers having a minimum of ten (10) years experience in the design and manufacture of similar products and systems. Additionally, if requested, a record of at least five (5) previous, separate, similar successful installations in the last five (5) years shall be provided.

B. Manufacturer shall offer a 3 year limited warranty on all FRP products against defects in materials and workmanship.

C. Manufacturer shall be certified to the ISO 9001-2008 standard.

D. Manufacturer shall provide proof of certification from at least two other quality assurance programs for its facilities or products (DNV, ABS, USCG, AARR).

1.5 PRODUCT DELIVERY AND STORAGE

A. Delivery of Materials: Manufactured materials shall be delivered in original, unbroken pallets, packages, containers, or bundles bearing the label of the manufacturer. Adhesives, resins and their catalysts and hardeners shall be crated or boxed separately and noted as such to facilitate their movement to a dry indoor storage facility.

B. Storage of Products: All materials shall be carefully handled to prevent them from abrasion, cracking, chipping, twisting, other deformations, and other types of damage. Store items in an enclosed area and free from contact with soil and water. Store adhesives, resins and their catalysts and hardeners in dry indoor storage facilities between 70 and 85 degrees Fahrenheit (21 to 29 degrees Celsius) until they are required.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Pultruded grating shall be Safe-T-Span® as manufactured by:

**Fibergrate Composite Structures Inc.**
5151 Belt Line Road, Suite 1212
Dallas, Texas 75254-7028 USA
(800) 527-4043 Phone (972) 250-1530 Fax

Website: www.fibergrate.com
E-mail: info@fibergrate.com

2.2 GENERAL

A. All FRP items furnished under this Section shall be composed of fiberglass reinforcement and resin in qualities, quantities, properties, arrangements and dimensions as necessary to meet the design requirements and dimensions as specified in the Contract Documents.

B. Fiberglass reinforcement shall be a combination of continuous roving, continuous strand mat, and surfacing veil in sufficient quantities as needed by the application and/or physical properties required.

C. Resins shall be {VINYL ESTER or ISOPHTHALIC - choose one} with chemical formulations as necessary to provide the corrosion resistance, strength and other physical properties as required.

D. All finished surfaces of FRP items and fabrications shall be smooth, resin-rich, free of voids and without dry spots, cracks, crazes or unreinforced areas. All glass fibers shall be well covered with resin to protect against their exposure due to wear or weathering.

E. All pultruded structural shapes shall be further protected from ultraviolet (UV) light with 1) integral UV inhibitors in the resin and 2) a synthetic surfacing veil to help produce a resin rich surface.

F. All FRP products shall have a tested flame spread rating of 25 or less per ASTM E-84 Tunnel Test. Gratings shall not burn past the 25 mm reference mark and will be classified HB per ASTM D635.

G. All grating clips shall be manufactured of Type 316SS (stainless steel).

## 2.3 PULTRUDED GRATING

A. Manufacture: Grating components shall be high strength and high stiffness pultruded elements having a maximum of 70% and a minimum of 60% glass content (by weight) of continuous roving and continuous strand mat fiberglass reinforcements. The finished surface of the product shall be provided with a surfacing veil to provide a resin rich surface which improves corrosion resistance and resistance to ultraviolet degradation. Bearing bars shall be interlocked and epoxied in place with a two piece cross rod system to provide a mechanical and chemical lock. Cross rods should be below the walking surface of the grating. Gratings with cross rods that are flush with the walking surface are excluded.

B. Non-slip surfacing: Grating shall be provided with a quartz grit bonded and baked to the top surface of the finished grating product.

C. Fire rating: Grating shall be fire retardant with a tested flame spread rating of 25 or less when tested in accordance with ASTM E 84. Manufacturer may be required to provide certification of ASTM E84 test on grating panels from an independent testing laboratory. Test data shall be from full scale testing of actual production grating, of the same type and material supplied on the project. Test data performed only on the base resin shall not be acceptable.

D. Resin system: The resin system used in the manufacture of the grating shall be {VEFR or ISOFR - choose one}. Manufacturer may be required to submit corrosion data from tests performed on actual grating products in standard chemical environments. Corrosion resistance data of the base resin from the manufacturer is not a true indicator of grating corrosion resistance and shall not be accepted.

E. Color: Gray or Yellow.

F. Depth: 1-1/2" deep load bars with a tolerance of plus or minus 1/32".

G. Mesh Configuration: 1" load bar spacing, 6" tie bar spacing on centers. Grating shall be SAFE-T-SPAN® I4015V or I4015I as manufactured by **Fibergrate Composite Structures Incorporated**

H. Load/Deflection: Grating shall meet manufacturers published safe recommended loadings with deflection not to exceed the following:

Uniform distributed load over a 60" span: 50 pounds per square foot, with a maximum deflection of 0.10".

I. Substitutions: Other products of equal strength, stiffness, corrosion resistance and overall quality may be submitted with the proper supporting data to the engineer for approval.

## 2.4 GRATING FABRICATION

A. Measurements: Grating supplied shall meet the minimum dimensional requirements as shown or specified. The Contractor shall provide and/or verify measurements in field for work fabricated to fit field conditions as required by grating manufacturer to complete the work. Determine correct size and locations of required holes or cutouts from field dimensions before grating fabrication.

B. Layout: Each grating section shall be readily removable, except where indicated on drawings. Manufacturer to provide openings and holes where located on the contract drawings. Grating supports shall be provided at openings in the grating by contractor where necessary to meet load/deflection requirements specified herein. Grating openings which fit around protrusions (pipes, cables, machinery, etc.) shall be discontinuous at approximately the centerline of opening so each section of grating is readily removable.

C. Sealing: All shop fabricated grating cuts shall be coated with vinyl ester resin to provide maximum corrosion resistance. All field fabricated grating cuts shall be coated similarly by the contractor in accordance with the manufacturer's instructions.

D. Hardware: Type 316 stainless steel hold-down clips shall be provided and spaced at a maximum of four feet apart with a minimum of four per piece of grating, or as recommended by the manufacturer.

# PART 3 - EXECUTION

## 3.1 INSPECTION

A. Shop inspection is authorized as required by the Owner and shall be at Owner's expense. The fabricator shall give ample notice to Contractor prior to the beginning of any fabrication work so that inspection may be provided. The grating shall be as free, as commercially possible, from visual defects such as foreign inclusions, delamination, blisters, resin burns, air bubbles and pits.

## 3.2 INSTALLATION

A. Contractor shall install gratings in accordance with manufacturer’s assembly drawings. Lock grating panels securely in place with hold-down fasteners as specified herein. Field cut and drill fiberglass reinforced plastic products with carbide or diamond tipped bits and blades. Seal cut or drilled surfaces in accordance with manufacturer's instructions. Follow manufacturer's instructions when cutting or drilling fiberglass products or using resin products; provide adequate ventilation.

# Division 7 - Thermal and Moisture Protection

SECTION 07620 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following sheet metal flashing and trim:

1. Manufactured through-wall flashing.
2. Manufactured reglets.
3. Formed roof drainage system.
4. Formed low-slope roof flashing and trim.
5. Formed steep-slope roof flashing and trim.
6. Formed wall flashing and trim.
7. Formed equipment support flashing.
8. Formed overhead-piping safety pans.

B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for installing reglets.
2. Division 4 Section "Unit Masonry Assemblies" for installing through-wall flashing, reglets, and other sheet metal flashing and trim.
3. Division 5 Section "Architectural Joint Systems" for manufactured sheet metal expansion-joint covers.
4. Division 6 Section "[**Rough Carpentry**] [**Miscellaneous Carpentry**]" for wood nailers, curbs, and blocking.
5. Division 7 Section "<**Insert Section title for roof shingles, shakes, or tiles**>" for installing sheet metal flashing and trim integral with roofing.
6. Division 7 Section "Metal Roof Panels" for factory-formed metal roof panels and flashing and trim not part of sheet metal flashing and trim.
7. Division 7 Section "Metal Wall Panels" for factory-formed metal wall panels and flashing and trim not part of sheet metal flashing and trim.
8. Division 7 Section "<**Insert Section title for type of membrane roofing system**>" for installing sheet metal flashing and trim integral with roofing membrane.
9. Division 7 Section "Sheet Metal Roofing" for custom-formed sheet metal roofing and flashing and trim not part sheet metal flashing and trim.
10. Division 7 Section "Manufactured Roof Specialties" for manufactured roof specialties not part of sheet metal flashing and trim.
11. Division 7 Section "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
12. Division 7 Section "Joint Sealants" for field-applied sheet metal flashing and trim sealants.

## 1.3 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Fabricate and install [**roof edge flashing**] [**and**] [**copings**] capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:

1. Wind Zone 1: For velocity pressures of 10 to 20 lbf/sq. ft. (0.48 to 0.96 kPa): 40-lbf/sq. ft. (1.92-kPa) perimeter uplift force, 60-lbf/sq. ft. (2.87-kPa) corner uplift force, and 20-lbf/sq. ft. (0.96-kPa) outward force.
2. Wind Zone 1: For velocity pressures of 21 to 30 lbf/sq. ft. (1.00 to 1.44 kPa): 60-lbf/sq. ft. (2.87-kPa) perimeter uplift force, 90-lbf/sq. ft. (4.31-kPa) corner uplift force, and 30-lbf/sq. ft. (1.44-kPa) outward force.
3. Wind Zone 2: For velocity pressures of 31 to 45 lbf/sq. ft. (1.48 to 2.15 kPa): 90-lbf/sq. ft. (4.31-kPa) perimeter uplift force, 120-lbf/sq. ft. (5.74-kPa) corner uplift force, and 45-lbf/sq. ft. (2.15-kPa) outward force.
4. Wind Zone 3: For velocity pressures of 46 to 104 lbf/sq. ft. (2.20 to 4.98 kPa): 208-lbf/sq. ft. (9.96-kPa) perimeter uplift force, 312-lbf/sq. ft. (14.94-kPa) corner uplift force, and 104-lbf/sq. ft. (4.98-kPa) outward force.

C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

## 1.4 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:

1. Identify material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.

4. Details of expansion-joint covers, including showing direction of expansion and contraction.

C. Samples for Initial Selection: For each type of sheet metal flashing and trim indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Sheet Metal Flashing: 12 inches (300 mm) long. Include fasteners, [**cleats,**] [**clips,**] closures, and other attachments.
2. Trim: 12 inches (300 mm) long. Include fasteners and other exposed accessories.
3. Accessories: Full-size Sample.

## 1.5 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

1. Copper Standard: Comply with CDA's "Copper in Architecture Handbook."

B. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical roof eave[**, including built-in gutter**] [**fascia**] [**fascia trim**] [**apron flashing**], approximately 48 inches (1200 mm) long, including supporting construction cleats, seams, attachments[**, underlayment,**] and accessories.
2. Approval of mockups is for other material and construction qualities specifically approved by Architect in writing.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
2. Review methods and procedures related to sheet metal flashing and trim.
3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
4. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

## 1.7 COORDINATION

A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

# PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

## 2.2 SHEET METALS

A. Copper Sheet: ASTM B 370, Temper H00 or H01, cold-rolled copper sheet.

B. Lead-Coated Copper Sheet: ASTM B 101, Temper H00 and H01, cold-rolled copper sheet, of weight (thickness) indicated below, coated both sides with lead weighing not less than 12 lb/100 sq. ft. (0.59 kg/sq. m) nor more than 15 lb/100 sq. ft. (0.73 kg/sq. m) of copper sheet (total weight of lead applied equally to both sides).

C. Aluminum Sheet: ASTM B 209 (ASTM B 209M), Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14, finished as follows:

1. Mill Finish: [**One-side**] [**Standard one-side**] [**Standard two-sides**] bright.

2. Alclad Finish: Metallurgically bonded surfacing to both sides, forming a composite aluminum sheet with reflective luster.
3. Factory Prime Coating: Where painting after installation is indicated, provide pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat; with a minimum dry film thickness of 0.2 mil (0.005 mm).
4. Siliconized-Polyester Coating: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.

    a. Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**].

5. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

    a. Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA [**2604**] [**2605**].
    b. Fluoropolymer 3-Coat System: Manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight, with a minimum total dry film thickness of 1.5 mil (0.038 mm); complying with AAMA 2605.

        1) Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**].

6. Anodized Finish: Apply the following coil-anodized finish:

    a. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.
    b. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
    c. Class II, Color Anodic Finish: AA-M12C22A34 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, electrolytically deposited color coating 0.010 mm or thicker) complying with AAMA 611.
    d. Class I, Color Anodic Finish: AA-M12C22A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

1) Color: [**Light bronze**] [**Medium bronze**] [**Dark bronze**] [**Black**].

D. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.

1. Finish: No. [**2D (dull, cold rolled)**] [**2B (bright, reflective)**] [**3 (reflective, polished directional satin)**] [**4 (fine reflective, polished directional satin)**].

E. Zinc-Tin Alloy-Coated Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead-soft, fully annealed stainless-steel sheet, coated on both sides with a zinc-tin alloy (50 percent zinc, 50 percent tin).

1. Product: Subject to compliance with requirements, provide "TCS II" by Follansbee Steel.

F. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality[**, mill phosphatized for field painting**].

G. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality[ **with manufacturer's standard clear acrylic coating both sides**].

H. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation; structural quality.
2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality.
3. Exposed Finishes: Apply the following coil coating:

a. Factory Prime Coating: Where painting after installation is indicated, provide pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat; with a minimum dry film thickness of 0.2 mil (0.005 mm).
b. Siliconized-Polyester Coating: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.

1) Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**].

c. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

1) Fluoropolymer 2-Coat System: Manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with physical properties and coating performance requirements of AAMA [**2604**] [**2605**], except as modified below:

a) Humidity Resistance: [**1000**] [**2000**] hours.
b) Salt-Spray Resistance: [**1000**] [**2000**] hours.

2) Fluoropolymer 3-Coat System: Manufacturer's standard 3-coat, thermocured system consisting of specially formulated inhibitive primer, fluoropolymer color coat, and clear fluoropolymer topcoat, with both color coat and clear topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight, with a minimum total dry film thickness of 1.5 mil (0.038 mm); complying with physical properties and coating performance requirements of AAMA 2605, except as modified below:

a) Humidity Resistance: [**1000**] [**2000**] hours.
b) Salt-Spray Resistance: [**1000**] [**2000**] hours.

3) Color: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**].

I. Lead Sheet: ASTM B 749, Type L51121, copper-bearing lead sheet.

J. Zinc Sheet: Electrolytic, 99 percent pure zinc alloyed with 1 percent titanium and copper.

1. Finish: [**Bright rolled**] [**Preweathered**].

## 2.3 UNDERLAYMENT MATERIALS

A. Polyethylene Sheet: 6-mil- (0.15-mm-) thick polyethylene sheet complying with ASTM D 4397.

B. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

C. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).

## 2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.

1. Nails for Copper Sheet: Copper, hardware bronze, or Series 300 stainless steel, 0.109 inch (2.8 mm) minimum and not less than 7/8 inch (22 mm) long, barbed with large head.
2. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
3. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
4. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

5. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

C. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.

D. Solder for Lead-Coated Copper: ASTM B 32, Grade Sn60, 60 percent tin and 40 percent lead.

E. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.

F. Solder for Zinc-Tin Alloy-Coated Stainless Steel: ASTM B 32, 100 percent tin.

G. Solder for Lead: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.

H. Solder for Zinc: ASTM B 32, 60 percent lead and 40 percent tin with low antimony, as recommended by manufacturer.

I. Burning Rod for Lead: Same composition as lead sheet.

J. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

K. Elastomeric Sealant: ASTM C 920, elastomeric [**polyurethane**] [**polysulfide**] [**silicone**] polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

L. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

M. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

N. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

O. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

## 2.5 MANUFACTURED SHEET METAL FLASHING AND TRIM

A. Through-Wall Ribbed Sheet Metal Flashing: Manufacture through-wall sheet metal flashing for embedment in masonry with ribs at 3-inch (75-mm) intervals along length of flashing to provide an integral mortar bond.[ **Manufacture through-wall flashing with snaplock receiver on exterior face to receive counterflashing.**]

1. Copper: 10 oz. (0.34 mm thick) minimum for fully concealed flashing; 16 oz. (0.55 mm thick) elsewhere.

a. [**Available** ]Products:

1) Advanced Building Products Inc.; Cop-R-Loc Interlocking Flashing.
2) Cheney Flashing Company, Inc.; Cheney Flashing (Dovetail).
3) Cheney Flashing Company, Inc.; Cheney Flashing (Sawtooth).
4) Dur-O-Wal, Dayton Superior Corporation; Polytite Copper Flashing.
5) Keystone Flashing Company, Inc.; Keystone Three-Way Interlocking Thruwall Flashing.
6) Sandell Manufacturing Company, Inc.; Three-Way Saw Tooth Flashing.
7) York Manufacturing, Inc.; Cop-R-Loc Interlocking Flashing.
8) <**Insert manufacturer's name; product.**>

2. Stainless Steel: 0.0156 inch (0.4 mm) thick.

a. [**Available** ]Products:

1) Cheney Flashing Company, Inc.; Cheney Flashing (Dovetail).
2) Cheney Flashing Company, Inc.; Cheney Flashing (Sawtooth).
3) Keystone Flashing Company, Inc.; Keystone Three-Way Interlocking Thruwall Flashing.

B. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated[ **with factory- mitered and -welded corners and junctions**].

1. [**Available** ]Manufacturers:

a. Cheney Flashing Company, Inc.
b. Fry Reglet Corporation.
c. Heckmann Building Products Inc.
d. Hickman, W. P. Company.
e. Keystone Flashing Company, Inc.
f. Sandell Manufacturing Company, Inc.
g. <**Insert manufacturer's name.**>

2. Material: [**Stainless steel, 0.0187 inch (0.5 mm) thick**] [**Copper, 16 oz./sq. ft. (0.55 mm thick)**] [**Lead-coated copper, 17.2 oz./sq. ft. (0.60 mm thick)**] [**Aluminum, 0.024 inch (0.6 mm) thick**] [**Galvanized steel, 0.0217 inch (0.55 mm) thick**].
3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
4. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
5. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
6. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
7. Flexible Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
8. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

## 2.6 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

D. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with [**elastomeric**] [**butyl**] sealant concealed within joints.

F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual"[ **and FMG Loss Prevention Data Sheet 1-49**] for application but not less than thickness of metal being secured.

## 2.7 ROOF DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, and other accessories as required. Fabricate in minimum 96-inch- (2400-mm-) long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers,[ **gutter bead reinforcing bars,**] and gutter accessories from same metal as gutters.

1. Gutter Style: [**A**] [**B**] [**C**] [**D**] [**E**] [**F**] [**G**] [**H**] [**I**] [**J**].
2. Expansion Joints: [**Lap type**] [**Butt type**] [**Built in**].
3. Accessories: [**Continuous removable leaf screen with sheet metal frame and hardware cloth screen**] [**Bronze wire ball downspout strainer**] [**Wire ball downspout strainer**] [**Valley baffles**].
4. Gutters with Girth up to 15 Inches (380 mm): Fabricate from the following material:

a. Copper: [**16 oz./sq. ft. (0.55 mm thick)**] <**Insert weight or thickness**>.
b. Lead-Coated Copper: [**17.2 oz./sq. ft. (0.60 mm thick)**] <**Insert weight or thickness**>.
c. Aluminum: [**0.0320 inch (0.8 mm)**] <**Insert thickness**> thick.
d. Stainless Steel: [**0.0156 inch (0.4 mm)**] <**Insert thickness**> thick.
e. Zinc-Tin Alloy-Coated Stainless Steel: [**0.015 inch (0.4 mm)**] <**Insert thickness**> thick.
f. Galvanized Steel: [**0.0217 inch (0.55 mm)**] <**Insert thickness**> thick.
g. Aluminum-Zinc Alloy-Coated Steel: [**0.0217 inch (0.55 mm)**] <**Insert thickness**> thick.
h. Prepainted, Metallic-Coated Steel: [**0.0217 inch (0.55 mm)**] <**Insert thickness**> thick.
i. Zinc: [**0.031 inch (0.80 mm)**] [**0.040 inch (1.0 mm)**] <**Insert thickness**> thick.

5. Gutters with Girth 16 to 20 Inches (410 to 510 mm): Fabricate from the following material:

a. Copper: [**16 oz./sq. ft. (0.55 mm thick)**] <**Insert weight or thickness**>.
b. Lead-Coated Copper: [**17.2 oz./sq. ft. (0.60 mm thick)**] <**Insert weight or thickness**>.
c. Aluminum: [**0.040 inch (1.0 mm)**] <**Insert thickness**> thick.
d. Stainless Steel: [**0.0187 inch (0.5 mm)**] <**Insert thickness**> thick.
e. Zinc-Tin Alloy-Coated Stainless Steel: [**0.018 inch (0.5 mm)**] <**Insert thickness**> thick.
f. Galvanized Steel: [**0.0276 inch (0.7 mm)**] <**Insert thickness**> thick.
g. Aluminum-Zinc Alloy-Coated Steel: [**0.0276 inch (0.7 mm)**] <**Insert thickness**> thick.
h. Prepainted, Metallic-Coated Steel: [**0.0276 inch (0.7 mm)**] <**Insert thickness**> thick.
i. Zinc: [**0.040 inch (1.0 mm)**] [**0.050 inch (1.2 mm)**] <**Insert thickness**> thick.

6. Gutters with Girth 21 to 25 Inches (530 to 640 mm): Fabricate from the following material:

a. Copper: [**20 oz./sq. ft. (0.7 mm thick)**] <**Insert weight or thickness**>.
b. Lead-Coated Copper: [**21.2 oz./sq. ft. (0.75 mm thick)**] <**Insert weight or thickness**>.
c. Aluminum: [**0.050 inch (1.2 mm)**] <**Insert thickness**> thick.
d. Stainless Steel: [**0.0250 inch (0.65 mm)**] <**Insert thickness**> thick.
e. Zinc-Tin Alloy-Coated Stainless Steel: [**0.0250 inch (0.65 mm)**] <**Insert thickness**> thick.
f. Galvanized Steel: [**0.0336 inch (0.85 mm)**] <**Insert thickness**> thick.
g. Aluminum-Zinc Alloy-Coated Steel: [**0.0336 inch (0.85 mm)**] <**Insert thickness**> thick.
h. Prepainted, Metallic-Coated Steel: [**0.0336 inch (0.85 mm)**] <**Insert thickness**> thick.
i. Zinc: [**0.050 inch (1.2 mm)**] [**0.060 inch (1.5 mm)**] <**Insert thickness**> thick.

7. Gutters with Girth 26 to 30 Inches (660 to 760 mm): Fabricate from the following material:

a. Copper: [**24 oz./sq. ft. (0.82 mm thick)**] <**Insert weight or thickness**>.
b. Lead-Coated Copper: [**25 oz./sq. ft. (0.87 mm thick)**] <**Insert weight or thickness**>.
c. Aluminum: [**0.063 inch (1.6 mm)**] <**Insert thickness**> thick.
d. Stainless Steel: [**0.0312 inch (0.8 mm)**] <**Insert thickness**> thick.
e. Galvanized Steel: [**0.040 inch (1.0 mm)**] <**Insert thickness**> thick.
f. Prepainted, Metallic-Coated Steel: [**0.040 inch (1.0 mm)**] <**Insert thickness**> thick.

8. Gutters with Girth 31 to 35 Inches (790 to 890 mm): Fabricate from the following material:

a. Copper: [**24 oz./sq. ft. (0.82 mm thick)**] <**Insert weight or thickness**>.
b. Lead-Coated Copper: [**25 oz./sq. ft. (0.87 mm thick)**] <**Insert weight or thickness**>.
c. Stainless Steel: [**0.0375 inch (0.95 mm)**] <**Insert thickness**> thick.
d. Galvanized Steel: [**0.0516 inch (1.3 mm)**] <**Insert thickness**> thick.
e. Prepainted, Metallic-Coated Steel: [**0.0516 inch (1.3 mm)**] <**Insert thickness**> thick.

B. Built-in Gutters: Fabricate to cross section indicated, with riveted and soldered joints, complete with end pieces, outlet tubes, and other special accessories as required. Fabricate in minimum 96-inch- (2400-mm-) long sections. Fabricate expansion joints and accessories from same metal as gutters, unless otherwise indicated.

1. Fabricate gutters with built-in expansion joints[ **and gutter-end expansion joints at walls**].
2. Accessories: [**Continuous removable leaf screen with sheet metal frame and hardware cloth screen**] [**Bronze wire ball downspout strainer**] [**Wire ball downspout strainer**].
3. Fabricate built-in gutters from the following material:

a. Copper: [**16 oz./sq. ft. (0.55 mm thick)**] <**Insert weight or thickness**>.
b. Lead-Coated Copper: [**17.2 oz./sq. ft. (0.60 mm thick)**] <**Insert weight or thickness**>.
c. Stainless Steel: [**0.0156 inch (0.4 mm)**] <**Insert thickness**> thick.
d. Zinc-Tin Alloy-Coated Stainless Steel: [**0.015 inch (0.4 mm)**] <**Insert thickness**> thick.
e. Zinc: [**0.031 inch (0.80 mm)**] [**0.040 inch (1.0 mm)**] <**Insert thickness**> thick.

C. Downspouts: Fabricate [**round**] [**rectangular**] [**open-face**] downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.

1. Manufactured Hanger Style: <**Insert description.**>
2. Fabricate downspouts from the following material:

a. Copper: [**16 oz./sq. ft. (0.55 mm thick)**] <**Insert weight or thickness**>.
b. Lead-Coated Copper: [**17.2 oz./sq. ft. (0.60 mm thick)**] <**Insert weight or thickness**>.
c. Aluminum: [**0.024 inch (0.6 mm)**] <**Insert thickness**> thick.
d. Stainless Steel: [**0.0156 inch (0.4 mm)**] <**Insert thickness**> thick.

e. Zinc-Tin Alloy-Coated Stainless Steel: [**0.015 inch (0.4 mm)**] <**Insert thickness**> thick.
f. Galvanized Steel: [**0.0217 inch (0.55 mm)**] <**Insert thickness**> thick.
g. Aluminum-Zinc Alloy-Coated Steel: [**0.0217 inch (0.55 mm)**] <**Insert thickness**> thick.
h. Prepainted, Metallic-Coated Steel: [**0.0217 inch (0.55 mm)**] <**Insert thickness**> thick.
i. Zinc: [**0.031 inch (0.80 mm)**] [**0.040 inch (1.0 mm)**] <**Insert thickness**> thick.

D. Parapet Scuppers: Fabricate scuppers of dimensions required with closure flange trim to exterior, 4-inch- (100-mm-) wide wall flanges to interior, and base extending 4 inches (100 mm) beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.

1. Fabricate parapet scuppers from the following material:

a. Copper: [**16 oz./sq. ft. (0.55 mm thick)**] <**Insert weight or thickness**>.
b. Lead-Coated Copper: [**17.2 oz./sq. ft. (0.60 mm thick)**] <**Insert weight or thickness**>.
c. Aluminum: [**0.0320 inch (0.8 mm)**] <**Insert thickness**> thick.
d. Stainless Steel: [**0.0187 inch (0.5 mm)**] <**Insert thickness**> thick.
e. Zinc-Tin Alloy-Coated Stainless Steel: [**0.018 inch (0.5 mm)**] <**Insert thickness**> thick.
f. Galvanized Steel: [**0.0276 inch (0.7 mm)**] <**Insert thickness**> thick.
g. Aluminum-Zinc Alloy-Coated Steel: [**0.0276 inch (0.7 mm)**] <**Insert thickness**> thick.
h. Prepainted, Metallic-Coated Steel: [**0.0276 inch (0.7 mm)**] <**Insert thickness**> thick.
i. Zinc: [**0.031 inch (0.80 mm)**] [**0.040 inch (1.0 mm)**] <**Insert thickness**> thick.

E. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape indicated complete with outlet tubes[**, exterior flange trim**] [**, and**] [**built-in overflows**].

1. Fabricate conductor heads from the following material:

a. Copper: [**16 oz./sq. ft. (0.55 mm thick)**] <**Insert weight or thickness**>.
b. Lead-Coated Copper: [**17.2 oz./sq. ft. (0.60 mm thick)**] <**Insert weight or thickness**>.
c. Aluminum: [**0.0320 inch (0.8 mm)**] <**Insert thickness**> thick.
d. Stainless Steel: [**0.0156 inch (0.4 mm)**] <**Insert thickness**> thick.
e. Zinc-Tin Alloy-Coated Stainless Steel: [**0.015 inch (0.4 mm)**] <**Insert thickness**> thick.
f. Galvanized Steel: [**0.0276 inch (0.7 mm)**] <**Insert thickness**> thick.
g. Aluminum-Zinc Alloy-Coated Steel: [**0.0276 inch (0.7 mm)**] <**Insert thickness**> thick.
h. Prepainted, Metallic-Coated Steel: [**0.0276 inch (0.7 mm)**] <**Insert thickness**> thick.
i. Zinc: [**0.031 inch (0.80 mm)**] [**0.040 inch (1.0 mm)**] <**Insert thickness**> thick.

## 2.8 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Roof Edge Flashing (Gravel Stop) and Fascia Caps: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 10-foot- (3-m-) long, sections. Furnish with 6-inch- (150-mm-) wide joint cover plates.

1. Joint Style: [**Lap, 4 inches (100 mm) wide**] [**Butt, with 12-inch- (300-mm-) wide concealed backup plate**] [**Butt, with 6-inch- (150-mm-) wide exposed cover plates**] [**Butt, with 12-inch- (300-mm-) wide concealed backup plate and 6-inch- (150-mm-) wide exposed cover plates**].
2. Fabricate with scuppers spaced 10 feet (3 m) <**Insert spacing**> apart, of dimensions required with 4-inch- (100-mm-) wide flanges and base extending 4 inches (100 mm) beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper.
3. Fabricate scuppers from the following material:

    a. Copper: [**20 oz./sq. ft. (0.7 mm thick)**] <**Insert weight or thickness**>.
    b. Lead-Coated Copper: [**21.2 oz./sq. ft. (0.75 mm thick)**] <**Insert weight or thickness**>.
    c. Aluminum: [**0.050 inch (1.2 mm)**] <**Insert thickness**> thick.
    d. Stainless Steel: [**0.0187 inch (0.5 mm)**] <**Insert thickness**> thick.
    e. Zinc-Tin Alloy-Coated Stainless Steel: [**0.018 inch (0.5 mm)**] <**Insert thickness**> thick.
    f. Galvanized Steel: [**0.0276 inch (0.7 mm)**] <**Insert thickness**> thick.
    g. Aluminum-Zinc Alloy-Coated Steel: [**0.0276 inch (0.7 mm)**] <**Insert thickness**> thick.
    h. Prepainted, Metallic-Coated Steel: [**0.0276 inch (0.7 mm)**] <**Insert thickness**> thick.
    i. Zinc: [**0.050 inch (1.2 mm)**] [**0.060 inch (1.5 mm)**] <**Insert thickness**> thick.

B. Copings: Fabricate in minimum 96-inch- (2400-mm-) long, but not exceeding 10-foot- (3-m-) long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and[ **drill elongated holes for fasteners on**] interior leg. Miter corners, seal, and solder or weld watertight.

1. Joint Style: [**Butt, with 12-inch- (300-mm-) wide concealed backup plate**] [**Butt, with 6-inch- (150-mm-) wide exposed cover plates**] [**Butt, with 12-inch- (300-mm-) wide concealed backup plate and 6-inch- (150-mm-) wide exposed cover plates**].
2. Fabricate copings from the following material:

    a. Copper: [**24 oz./sq. ft. (0.82 mm thick)**] <**Insert weight or thickness**>.
    b. Lead-Coated Copper: [**25 oz./sq. ft. (0.87 mm thick)**] <**Insert weight or thickness**>.
    c. Aluminum: [**0.050 inch (1.2 mm)**] <**Insert thickness**> thick.
    d. Stainless Steel: [**0.0250 inch (0.65 mm)**] <**Insert thickness**> thick.
    e. Zinc-Tin Alloy-Coated Stainless Steel: [**0.0250 inch (0.65 mm)**] <**Insert thickness**> thick.
    f. Galvanized Steel: [**0.0396 inch (1.0 mm)**] <**Insert thickness**> thick.
    g. Aluminum-Zinc Alloy-Coated Steel: [**0.0396 inch (1.0 mm)**] <**Insert thickness**> thick.

h. Prepainted, Metallic-Coated Steel: [**0.0396 inch (1.0 mm)**] <**Insert thickness**> thick.
i. Zinc: [**0.050 inch (1.2 mm)**] [**0.060 inch (1.5 mm)**] <**Insert thickness**> thick.

C. [**Roof**] [**and**] [**Roof to Wall Transition**] [**Roof to Sheet Metal Roof Edging Transition**] Expansion-Joint Cover: Fabricate from the following material:

1. Copper: [**16 oz./sq. ft. (0.55 mm thick)**] <**Insert weight or thickness**>.
2. Lead-Coated Copper: [**17.2 oz./sq. ft. (0.60 mm thick)**] <**Insert weight or thickness**>.
3. Aluminum: [**0.050 inch (1.2 mm)**] <**Insert thickness**> thick.
4. Stainless Steel: [**0.0250 inch (0.65 mm)**] <**Insert thickness**> thick.
5. Zinc-Tin Alloy-Coated Stainless Steel: [**0.0250 inch (0.65 mm)**] <**Insert thickness**> thick.
6. Galvanized Steel: [**0.0336 inch (0.85 mm)**] <**Insert thickness**> thick.
7. Aluminum-Zinc Alloy-Coated Steel: [**0.0336 inch (0.85 mm)**] <**Insert thickness**> thick.
8. Prepainted, Metallic-Coated Steel: [**0.0336 inch (0.85 mm)**] <**Insert thickness**> thick.
9. Zinc: [**0.031 inch (0.80 mm)**] [**0.040 inch (1.0 mm)**] <**Insert thickness**> thick.

D. Base Flashing: Fabricate from the following material:

1. Copper: [**20 oz./sq. ft. (0.7 mm thick)**] <**Insert weight or thickness**>.
2. Lead-Coated Copper: [**21.2 oz./sq. ft. (0.75 mm thick)**] <**Insert weight or thickness**>.
3. Aluminum: [**0.040 inch (1.0 mm)**] <**Insert thickness**> thick.
4. Stainless Steel: [**0.0187 inch (0.5 mm)**] <**Insert thickness**> thick.
5. Zinc-Tin Alloy-Coated Stainless Steel: [**0.018 inch (0.5 mm)**] <**Insert thickness**> thick.
6. Galvanized Steel: [**0.0276 inch (0.7 mm)**] <**Insert thickness**> thick.
7. Aluminum-Zinc Alloy-Coated Steel: [**0.0276 inch (0.7 mm)**] <**Insert thickness**> thick.
8. Prepainted, Metallic-Coated Steel: [**0.0276 inch (0.7 mm)**] <**Insert thickness**> thick.
9. Zinc: [**0.031 inch (0.80 mm)**] [**0.040 inch (1.0 mm)**] <**Insert thickness**> thick.

E. Counterflashing: Fabricate from the following material:

1. Copper: [**16 oz./sq. ft. (0.55 mm thick)**] <**Insert weight or thickness**>.
2. Lead-Coated Copper: [**17.2 oz./sq. ft. (0.60 mm thick)**] <**Insert weight or thickness**>.
3. Aluminum: [**0.0320 inch (0.8 mm)**] <**Insert thickness**> thick.
4. Stainless Steel: [**0.0187 inch (0.5 mm)**] <**Insert thickness**> thick.
5. Zinc-Tin Alloy-Coated Stainless Steel: [**0.018 inch (0.5 mm)**] <**Insert thickness**> thick.
6. Galvanized Steel: [**0.0217 inch (0.55 mm)**] <**Insert thickness**> thick.
7. Aluminum-Zinc Alloy-Coated Steel: [**0.0217 inch (0.55 mm)**] <**Insert thickness**> thick.
8. Prepainted, Metallic-Coated Steel: [**0.0217 inch (0.55 mm)**] <**Insert thickness**> thick.
9. Zinc: [**0.031 inch (0.80 mm)**] [**0.040 inch (1.0 mm)**] <**Insert thickness**> thick.

F. Flashing Receivers: Fabricate from the following material:

1. Copper: [**16 oz./sq. ft. (0.55 mm thick)**] <**Insert weight or thickness**>.
2. Lead-Coated Copper: [**17.2 oz./sq. ft. (0.60 mm thick)**] <**Insert weight or thickness**>.
3. Aluminum: [**0.0320 inch (0.8 mm)**] <**Insert thickness**> thick.
4. Stainless Steel: [**0.0156 inch (0.4 mm)**] <**Insert thickness**> thick.
5. Zinc-Tin Alloy-Coated Stainless Steel: [**0.015 inch (0.4 mm)**] <**Insert thickness**> thick.
6. Galvanized Steel: [**0.0217 inch (0.55 mm)**] <**Insert thickness**> thick.
7. Aluminum-Zinc Alloy-Coated Steel: [**0.0217 inch (0.55 mm)**] <**Insert thickness**> thick.

8. Prepainted, Metallic-Coated Steel: [**0.0217 inch (0.55 mm)**] <**Insert thickness**> thick.
9. Zinc: [**0.031 inch (0.80 mm)**] [**0.040 inch (1.0 mm)**] <**Insert thickness**> thick.

G. Roof-Penetration Flashing: Fabricate from the following material:

1. Lead: [**4.0 lb/sq. ft. (1.6 mm thick)**] <**Insert weight or thickness**>, hard tempered.
2. Copper: [**16 oz./sq. ft. (0.55 mm thick)**] <**Insert weight or thickness**>.
3. Lead-Coated Copper: [**17.2 oz./sq. ft. (0.60 mm thick)**] <**Insert weight or thickness**>.
4. Stainless Steel: [**0.0187 inch (0.5 mm)**] <**Insert thickness**> thick.
5. Zinc-Tin Alloy-Coated Stainless Steel: [**0.018 inch (0.5 mm)**] <**Insert thickness**> thick.
6. Galvanized Steel: [**0.0276 inch (0.7 mm)**] <**Insert thickness**> thick.
7. Aluminum-Zinc Alloy-Coated Steel: [**0.0276 inch (0.7 mm)**] <**Insert thickness**> thick.
8. Prepainted, Metallic-Coated Steel: [**0.0276 inch (0.7 mm)**] <**Insert thickness**> thick.
9. Zinc: [**0.031 inch (0.80 mm)**] [**0.040 inch (1.0 mm)**] <**Insert thickness**> thick.

H. Splash Pans: Fabricate from the following material:

1. Copper: [**16 oz./sq. ft. (0.55 mm thick)**] <**Insert weight or thickness**>.
2. Lead-Coated Copper: [**17.2 oz./sq. ft. (0.60 mm thick)**] <**Insert weight or thickness**>.
3. Aluminum: [**0.040 inch (1.0 mm)**] <**Insert thickness**> thick.
4. Stainless Steel: [**0.0187 inch (0.5 mm)**] <**Insert thickness**> thick.
5. Zinc-Tin Alloy-Coated Stainless Steel: [**0.018 inch (0.5 mm)**] <**Insert thickness**> thick.
6. Zinc: [**0.031 inch (0.80 mm)**] [**0.040 inch (1.0 mm)**] <**Insert thickness**> thick.

I. Roof-Drain Flashing: Fabricate from the following material:

1. Lead: [**4.0 lb/sq. ft. (1.6 mm thick)**] <**Insert weight or thickness**>, hard tempered.
2. Copper: [**13.2 oz./sq. ft. (0.45 mm thick)**] <**Insert weight or thickness**>.
3. Lead-Coated Copper: [**12 oz./sq. ft. (0.4 mm thick)**] <**Insert weight or thickness**>.
4. Stainless Steel: [**0.0156 inch (0.4 mm)**] <**Insert thickness**> thick.
5. Zinc-Tin Alloy-Coated Stainless Steel: [**0.015 inch (0.4 mm)**] <**Insert thickness**> thick.

## 2.9 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

A. Apron, Step, Cricket, and Backer Flashing: Fabricate from the following material:

1. Copper: [**16 oz./sq. ft. (0.55 mm thick)**] <**Insert weight or thickness**>.
2. Lead-Coated Copper: [**17.2 oz./sq. ft. (0.60 mm thick)**] <**Insert weight or thickness**>.
3. Aluminum: [**0.0320 inch (0.8 mm)**] <**Insert thickness**> thick.
4. Stainless Steel: [**0.0156 inch (0.4 mm)**] <**Insert thickness**> thick.
5. Zinc-Tin Alloy-Coated Stainless Steel: [**0.015 inch (0.4 mm)**] <**Insert thickness**> thick.
6. Galvanized Steel: [**0.0217 inch (0.55 mm)**] <**Insert thickness**> thick.
7. Aluminum-Zinc Alloy-Coated Steel: [**0.0217 inch (0.55 mm)**] <**Insert thickness**> thick.
8. Prepainted, Metallic-Coated Steel: [**0.0217 inch (0.55 mm)**] <**Insert thickness**> thick.
9. Zinc: [**0.031 inch (0.80 mm)**] [**0.040 inch (1.0 mm)**] <**Insert thickness**> thick.

B. Valley Flashing: Fabricate from the following material:

1. Copper: [**16 oz./sq. ft. (0.55 mm thick)**] <**Insert weight or thickness**>.
2. Lead-Coated Copper: [**17.2 oz./sq. ft. (0.60 mm thick)**] <**Insert weight or thickness**>.

3. Stainless Steel: [**0.0187 inch (0.5 mm)**] <**Insert thickness**> thick.
4. Zinc-Tin Alloy-Coated Stainless Steel: [**0.018 inch (0.5 mm)**] <**Insert thickness**> thick.
5. Prepainted, Metallic-Coated Steel: [**0.0276 inch (0.7 mm)**] <**Insert thickness**> thick.
6. Zinc: [**0.031 inch (0.80 mm)**] [**0.040 inch (1.0 mm)**] <**Insert thickness**> thick.

C. Drip Edges: Fabricate from the following material:

1. Copper: [**16 oz./sq. ft. (0.55 mm thick)**] <**Insert weight or thickness**>.
2. Lead-Coated Copper: [**17.2 oz./sq. ft. (0.60 mm thick)**] <**Insert weight or thickness**>.
3. Aluminum: [**0.0320 inch (0.8 mm)**] <**Insert thickness**> thick.
4. Stainless Steel: [**0.0156 inch (0.4 mm)**] <**Insert thickness**> thick.
5. Zinc-Tin Alloy-Coated Stainless Steel: [**0.015 inch (0.4 mm)**] <**Insert thickness**> thick.
6. Galvanized Steel: [**0.0217 inch (0.55 mm)**] <**Insert thickness**> thick.
7. Aluminum-Zinc Alloy-Coated Steel: [**0.0217 inch (0.55 mm)**] <**Insert thickness**> thick.
8. Prepainted, Metallic-Coated Steel: [**0.0217 inch (0.55 mm)**] <**Insert thickness**> thick.
9. Zinc: [**0.031 inch (0.80 mm)**] [**0.040 inch (1.0 mm)**] <**Insert thickness**> thick.

D. Eave, Rake[**, Ridge, and Hip**] Flashing: Fabricate from the following material:

1. Copper: [**16 oz./sq. ft. (0.55 mm thick)**] <**Insert weight or thickness**>.
2. Lead-Coated Copper: [**17.2 oz./sq. ft. (0.60 mm thick)**] <**Insert weight or thickness**>.
3. Aluminum: [**0.0320 inch (0.8 mm)**] <**Insert thickness**> thick.
4. Stainless Steel: [**0.0156 inch (0.4 mm)**] <**Insert thickness**> thick.
5. Zinc-Tin Alloy-Coated Stainless Steel: [**0.015 inch (0.4 mm)**] <**Insert thickness**> thick.
6. Galvanized Steel: [**0.0217 inch (0.55 mm)**] <**Insert thickness**> thick.
7. Aluminum-Zinc Alloy-Coated Steel: [**0.0217 inch (0.55 mm)**] <**Insert thickness**> thick.
8. Prepainted, Metallic-Coated Steel: [**0.0217 inch (0.55 mm)**] <**Insert thickness**> thick.
9. Zinc: [**0.031 inch (0.80 mm)**] [**0.040 inch (1.0 mm)**] <**Insert thickness**> thick.

E. Base Flashing: Fabricate from the following material:

1. Copper: [**20 oz./sq. ft. (0.7 mm thick)**] <**Insert weight or thickness**>.
2. Lead-Coated Copper: [**21.2 oz./sq. ft. (0.75 mm thick)**] <**Insert weight or thickness**>.
3. Aluminum: [**0.040 inch (1.0 mm)**] <**Insert thickness**> thick.
4. Stainless Steel: [**0.0187 inch (0.5 mm)**] <**Insert thickness**> thick.
5. Zinc-Tin Alloy-Coated Stainless Steel: [**0.018 inch (0.5 mm)**] <**Insert thickness**> thick.
6. Galvanized Steel: [**0.0276 inch (0.7 mm)**] <**Insert thickness**> thick.
7. Aluminum-Zinc Alloy-Coated Steel: [**0.0276 inch (0.7 mm)**] <**Insert thickness**> thick.
8. Prepainted, Metallic-Coated Steel: [**0.0276 inch (0.7 mm)**] <**Insert thickness**> thick.
9. Zinc: [**0.031 inch (0.80 mm)**] [**0.040 inch (1.0 mm)**] <**Insert thickness**> thick.

F. Counterflashing: Fabricate from the following material:

1. Copper: [**16 oz./sq. ft. (0.55 mm thick)**] <**Insert weight or thickness**>.
2. Lead-Coated Copper: [**17.2 oz./sq. ft. (0.60 mm thick)**] <**Insert weight or thickness**>.
3. Aluminum: [**0.0320 inch (0.8 mm)**] <**Insert thickness**> thick.
4. Stainless Steel: [**0.0187 inch (0.5 mm)**] <**Insert thickness**> thick.
5. Zinc-Tin Alloy-Coated Stainless Steel: [**0.018 inch (0.5 mm)**] <**Insert thickness**> thick.
6. Galvanized Steel: [**0.0217 inch (0.55 mm)**] <**Insert thickness**> thick.
7. Aluminum-Zinc Alloy-Coated Steel: [**0.0217 inch (0.55 mm)**] <**Insert thickness**> thick.
8. Prepainted, Metallic-Coated Steel: [**0.0217 inch (0.55 mm)**] <**Insert thickness**> thick.

9. Zinc: [**0.031 inch (0.80 mm)**] [**0.040 inch (1.0 mm)**] <**Insert thickness**> thick.

G. Flashing Receivers: Fabricate from the following material:

1. Copper: [**16 oz./sq. ft. (0.55 mm thick)**] <**Insert weight or thickness**>.
2. Lead-Coated Copper: [**17.2 oz./sq. ft. (0.60 mm thick)**] <**Insert weight or thickness**>.
3. Aluminum: [**0.0320 inch (0.8 mm)**] <**Insert thickness**> thick.
4. Stainless Steel: [**0.0156 inch (0.4 mm)**] <**Insert thickness**> thick.
5. Zinc-Tin Alloy-Coated Stainless Steel: [**0.015 inch (0.4 mm)**] <**Insert thickness**> thick.
6. Galvanized Steel: [**0.0217 inch (0.55 mm)**] <**Insert thickness**> thick.
7. Aluminum-Zinc Alloy-Coated Steel: [**0.0217 inch (0.55 mm)**] <**Insert thickness**> thick.
8. Prepainted, Metallic-Coated Steel: [**0.0217 inch (0.55 mm)**] <**Insert thickness**> thick.
9. Zinc: [**0.031 inch (0.80 mm)**] [**0.040 inch (1.0 mm)**] <**Insert thickness**> thick.

H. Roof-Penetration Flashing: Fabricate from the following material:

1. Lead: [**4.0 lb/sq. ft. (1.6 mm thick)**] <**Insert weight or thickness**>, hard tempered.
2. Copper: [**16 oz./sq. ft. (0.55 mm thick)**] <**Insert weight or thickness**>.
3. Lead-Coated Copper: [**17.2 oz./sq. ft. (0.60 mm thick)**] <**Insert weight or thickness**>.
4. Stainless Steel: [**0.0187 inch (0.5 mm)**] <**Insert thickness**> thick.
5. Zinc-Tin Alloy-Coated Stainless Steel: [**0.018 inch (0.5 mm)**] <**Insert thickness**> thick.
6. Galvanized Steel: [**0.0276 inch (0.7 mm)**] <**Insert thickness**> thick.
7. Aluminum-Zinc Alloy-Coated Steel: [**0.0276 inch (0.7 mm)**] <**Insert thickness**> thick.
8. Prepainted, Metallic-Coated Steel: [**0.0276 inch (0.7 mm)**] <**Insert thickness**> thick.
9. Zinc: [**0.031 inch (0.80 mm)**] [**0.040 inch (1.0 mm)**] <**Insert thickness**> thick.

## 2.10 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- (2400-mm-) long, but not exceeding 12 foot (3.6 m) long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches (150 mm) beyond each side of wall openings. Form with 2-inch- (50-mm-) high end dams. Fabricate from the following material:

1. Copper: [**16 oz./sq. ft. (0.55 mm thick)**] <**Insert weight or thickness**>.
2. Lead-Coated Copper: [**17.2 oz./sq. ft. (0.60 mm thick)**] <**Insert weight or thickness**>.
3. Stainless Steel: [**0.0156 inch (0.4 mm)**] <**Insert thickness**> thick.
4. Zinc-Tin Alloy-Coated Stainless Steel: [**0.015 inch (0.4 mm)**] <**Insert thickness**> thick.
5. Zinc: [**0.031 inch (0.80 mm)**] [**0.040 inch (1.0 mm)**] <**Insert thickness**> thick.

B. Openings Flashing in Frame Construction: Fabricate head, sill,[ **jamb,**] and similar flashings to extend [**4 inches (100 mm)**] <**Insert extension**> beyond wall openings. Form head and sill flashing with 2-inch- (50-mm-) high end dams. Fabricate from the following material:

1. Copper: [**16 oz./sq. ft. (0.55 mm thick)**] <**Insert weight or thickness**>.
2. Lead-Coated Copper: [**17.2 oz./sq. ft. (0.60 mm thick)**] <**Insert weight or thickness**>.
3. Aluminum: [**0.0320 inch (0.8 mm)**] <**Insert thickness**> thick.
4. Stainless Steel: [**0.0156 inch (0.4 mm)**] <**Insert thickness**> thick.
5. Zinc-Tin Alloy-Coated Stainless Steel: [**0.015 inch (0.4 mm)**] <**Insert thickness**> thick.
6. Galvanized Steel: [**0.0217 inch (0.55 mm)**] <**Insert thickness**> thick.

7. Aluminum-Zinc Alloy-Coated Steel: [**0.0217 inch (0.55 mm)**] <**Insert thickness**> thick.
8. Prepainted, Metallic-Coated Steel: [**0.0217 inch (0.55 mm)**] <**Insert thickness**> thick.
9. Zinc: [**0.031 inch (0.80 mm)**] [**0.040 inch (1.0 mm)**] <**Insert thickness**> thick.

C. Wall Expansion-Joint Cover: Fabricate from the following material:

1. Copper: [**16 oz./sq. ft. (0.55 mm thick)**] <**Insert weight or thickness**>.
2. Lead-Coated Copper: [**17.2 oz./sq. ft. (0.60 mm thick)**] <**Insert weight or thickness**>.
3. Aluminum: [**0.040 inch (1.0 mm)**] <**Insert thickness**> thick.
4. Stainless Steel: [**0.0187 inch (0.5 mm)**] <**Insert thickness**> thick.
5. Zinc-Tin Alloy-Coated Stainless Steel: [**0.018 inch (0.5 mm)**] <**Insert thickness**> thick.
6. Galvanized Steel: [**0.0276 inch (0.7 mm)**] <**Insert thickness**> thick.
7. Aluminum-Zinc Alloy-Coated Steel: [**0.0276 inch (0.7 mm)**] <**Insert thickness**> thick.
8. Prepainted, Metallic-Coated Steel: [**0.0276 inch (0.7 mm)**] <**Insert thickness**> thick.
9. Zinc: [**0.031 inch (0.80 mm)**] [**0.040 inch (1.0 mm)**] <**Insert thickness**> thick.

## 2.11 MISCELLANEOUS SHEET METAL FABRICATIONS

A. Equipment Support Flashing: Fabricate from the following material:

1. Copper: [**16 oz./sq. ft. (0.55 mm thick)**] <**Insert weight or thickness**>.
2. Lead-Coated Copper: [**17.2 oz./sq. ft. (0.60 mm thick)**] <**Insert weight or thickness**>.
3. Stainless Steel: [**0.0187 inch (0.5 mm)**] <**Insert thickness**> thick.
4. Zinc-Tin Alloy-Coated Stainless Steel: [**0.018 inch (0.5 mm)**] <**Insert thickness**> thick.
5. Galvanized Steel: [**0.0276 inch (0.7 mm)**] <**Insert thickness**> thick.
6. Aluminum-Zinc Alloy-Coated Steel: [**0.0276 inch (0.7 mm)**] <**Insert thickness**> thick.
7. Prepainted, Metallic-Coated Steel: [**0.0276 inch (0.7 mm)**] <**Insert thickness**> thick.

B. Overhead-Piping Safety Pans: Fabricate from the following material:

1. Copper: [**24 oz./sq. ft. (0.82 mm thick)**] <**Insert weight or thickness**>.
2. Lead-Coated Copper: [**25 oz./sq. ft. (0.87 mm thick)**] <**Insert weight or thickness**>.
3. Stainless Steel: [**0.0250 inch (0.65 mm)**] <**Insert thickness**> thick.
4. Zinc-Tin Alloy-Coated Stainless Steel: [**0.0250 inch (0.65 mm)**] <**Insert thickness**> thick.
5. Galvanized Steel: [**0.0396 inch (1.0 mm)**] <**Insert thickness**> thick.
6. Prepainted, Metallic-Coated Steel: [**0.0276 inch (0.7 mm)**] <**Insert thickness**> thick.

## 2.12 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are

acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.

1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.

1. Coat side of [**uncoated aluminum**] [**stainless-steel**] [**and**] [**lead**] sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and [**elastomeric**] [**butyl**] sealant.

E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

1. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with [**elastomeric**] [**butyl**] sealant concealed within joints.

G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.

1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.
2. Aluminum: Use aluminum or stainless-steel fasteners.
3. Copper: Use copper, hardware bronze, or stainless-steel fasteners.
4. Stainless Steel: Use stainless-steel fasteners.

H. Seal joints with [**elastomeric**] [**butyl**] sealant as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
2. Prepare joints and apply sealants to comply with requirements in Division 7 Section "Joint Sealants."

I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm) except where pretinned surface would show in finished Work.

1. Do not solder [**prepainted, metallic-coated steel**] [**and**] [**aluminum**] sheet.
2. Pretinning is not required for [**lead-coated copper**] [**zinc-tin alloy-coated stainless steel**] [**and**] [**lead**].
3. Stainless-Steel Soldering: Pretin edges of uncoated sheets to be soldered using solder recommended for stainless steel and phosphoric acid flux. Promptly wash off acid flux residue from metal after soldering.
4. Copper Soldering: Tin uncoated copper surfaces at edges of sheets using solder recommended for copper work.
5. Where surfaces to be soldered are lead coated, do not tin edges, but wire brush lead coating before soldering.
6. Lead-Coated Copper Soldering: Wire brush edges of sheets before soldering.
7. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

J. Aluminum Flashing: Rivet or weld joints in uncoated aluminum where necessary for strength.

## 3.3 ROOF DRAINAGE SYSTEM INSTALLATION

A. General: Install sheet metal roof drainage items to produce complete roof drainage system according to SMACNA recommendations and as indicated. Coordinate installation of roof perimeter flashing with installation of roof drainage system.

B. Hanging Gutters: Join sections with riveted and soldered joints or with lapped joints sealed with [**elastomeric**] [**butyl**] sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchored [**gutter brackets**] [**straps**] spaced not more than 36 inches (900 mm) apart. Provide end closures and seal watertight with sealant. Slope to downspouts.

1. Fasten gutter spacers to front and back of gutter.
2. Loosely lock straps to front gutter bead and anchor to roof deck.
3. Anchor and loosely lock back edge of gutter to continuous [**cleat**] [**eave or apron flashing**].
4. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches (600 mm) apart.
5. Anchor gutter with spikes and ferrules spaced not more than [**24 inches (600 mm)**] [**30 inches (750 mm)**] apart.
6. Install gutter with expansion joints at locations indicated but not exceeding 50 feet (15.24 m) apart. Install expansion joint caps.
7. Install continuous gutter screens on gutters with noncorrosive fasteners, [**removable**] [**hinged to swing open**] for cleaning gutters.

C. Built-in Gutters: Join sections with riveted and soldered or lapped joints sealed with [**elastomeric**] [**butyl**] sealant. Provide for thermal expansion. Slope to downspouts. Provide end closures and seal watertight with sealant.

1. Install felt underlayment layer in built-in gutter trough and extend to drip edge at eaves and under felt underlayment on roof sheathing. Lap sides a minimum of 2 inches (50 mm) over underlying course. Lap ends a minimum of 4 inches (100 mm). Stagger end laps between succeeding courses at least 72 inches (1830 mm). Fasten with roofing nails. Install slip sheet over felt underlayment.
2. Anchor and loosely lock back edge of gutter to continuous [**cleat**] [**eave or apron flashing**].
3. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches (600 mm) apart.
4. Install gutter with expansion joints at locations indicated but not exceeding 50 feet (15.24 m) apart. Install expansion joint caps.

D. Downspouts: Join sections with 1-1/2-inch (38-mm) telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch (25 mm) away from walls; locate fasteners at top and bottom and at approximately 60 inches (1500 mm) o.c. in between.

1. Provide elbows at base of downspout to direct water away from building.
2. Connect downspouts to underground drainage system indicated.

E. Parapet Scuppers: Install scuppers where indicated through parapet. Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.

1. Anchor scupper closure trim flange to exterior wall and seal or solder to scupper.
2. Loosely lock front edge of scupper with conductor head.
3. Seal or solder exterior wall scupper flanges into back of conductor head.

F. Conductor Heads: Anchor securely to wall with elevation of conductor head rim 1 inch (25 mm) below [**scupper**] [**gutter**] discharge.

G. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated. Lap joints a minimum of 4 inches (100 mm) in direction of water flow.

H. Splash Pans: Install where downspouts discharge on low-sloped roofs. Set in [**asphalt roofing cement**] [**elastomeric sealant**] [**butyl sealant**] compatible with roofing membrane.

## 3.4 ROOF FLASHING INSTALLATION

A. General: Install sheet metal roof flashing and trim to comply with performance requirements[**, sheet metal manufacturer's written installation instructions,**] and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.

1. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at [**24-inch (600-mm)**] [**16-inch (400-mm)**] <**Insert spacing**> centers.

C. Copings: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.

1. Interlock exterior bottom edge of coping with continuous cleats anchored to substrate at [**24-inch (600-mm)**] [**16-inch (400-mm)**] <**Insert spacing**> centers.
2. Anchor interior leg of coping with screw fasteners and washers at [**24-inch (600-mm)**] [**20-inch (500-mm)**] [**18-inch (450-mm)**] <**Insert spacing**> centers.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for [**elastomeric**] [**butyl**] sealant, extending a minimum of 4 inches (100 mm) over base flashing. Install stainless-steel draw band and tighten.

E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with [**elastomeric**] [**butyl**] sealant.

1. Secure in a waterproof manner by means of [**snap-in installation and sealant or lead wedges and sealant**] [**interlocking folded seam or blind rivets and sealant**] [**anchor and washer at 36-inch (900-mm) centers**].

F. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:

1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
2. Seal with [**elastomeric**] [**butyl**] sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

## 3.5 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Through-Wall Flashing: Installation of [**manufactured**] [**formed**] through-wall flashing is specified in Division 4 Section "[**Unit Masonry Assemblies**] [**Stone Veneer Assemblies**]."

C. Reglets: Installation of reglets is specified in Division [**3 Section "Cast-in-Place Concrete**] [**4 Section "Unit Masonry Assemblies**]."

D. Openings Flashing in Frame Construction: Install continuous head, sill,[ **jamb,**] and similar flashings to extend [**4 inches (100 mm)**] <**Insert extension**> beyond wall openings.

## 3.6 MISCELLANEOUS FLASHING INSTALLATION

A. Overhead-Piping Safety Pans: Suspend pans from pipe and install drain line to plumbing waste or drain line.

B. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with [**elastomeric**] [**butyl**] sealant to equipment support member.

## 3.7 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07620

SECTION 07841 - THROUGH-PENETRATION FIRESTOP SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.

B. Related Sections include the following:

1. Division 7 Section "Fire-Resistive Joint Systems."
2. Division 13 Sections specifying fire-suppression piping penetrations.
3. Division 15 Sections specifying duct and piping penetrations.
4. Division 16 Sections specifying cable and conduit penetrations.

1.3 PERFORMANCE REQUIREMENTS

A. General: For penetrations through [**the following** ]fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

1. Fire-resistance-rated walls including [**fire walls**] [**fire partitions**] [**fire barriers**] [**and**] [**smoke barriers**].
2. Fire-resistance-rated horizontal assemblies including [**floors**] [**floor/ceiling assemblies**] [**and**] [**ceiling membranes of roof/ceiling assemblies**].

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per [**ASTM E 814**] [**or**] [**UL 1479**]:

1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:

a. Penetrations located outside wall cavities.
b. Penetrations located outside fire-resistance-rated shaft enclosures.

3. L-Rated Systems: [**Where through-penetration firestop systems are indicated in smoke barriers, provide**] [**Provide**] through-penetration firestop systems with L-ratings [**indicated**] [**of not more than**] [**3.0 cfm/sq. ft (0.01524cu. m/s x sq. m)**] <**Insert rating**> at both ambient temperatures and 400 deg F (204 deg C).

C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
2. For floor penetrations with annular spaces exceeding 4 inches (100 mm) in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

## 1.4 SUBMITTALS

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

B. Shop Drawings: For each through-penetration firestop system, show each type of construction condition penetrated, relationships to adjoining construction, and type of penetrating item. Include firestop design designation of qualified testing and inspecting agency that evidences compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop system configuration for construction and penetrating items.
2. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

C. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:

1. Types of penetrating items.
2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.

D. Qualification Data: For Installer.

E. Product Certificates: For through-penetration firestop system products, signed by product manufacturer.

F. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm that has been approved by FMG according to FMG 4991, "Approval of Firestop Contractors."

B. Installer Qualifications: A firm experienced in installing through-penetration firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance.[ **Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its through-penetration firestop system products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.**]

C. Installation Responsibility: Assign installation of through-penetration firestop systems [**and fire-resistive joint systems** ]in Project to a single qualified installer.

D. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.

E. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:

1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is [**UL,**] [**OPL**] [**ITS,**] <**Insert name,**> or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
2. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems complying with the following requirements:

    a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
    b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:

        1) UL in its "Fire Resistance Directory."
        2) OPL in its "Directory of Listed Building Products, Materials, & Assemblies."
        3) ITS in its "Directory of Listed Products."
        4) <**Insert name of qualified testing and inspecting agency.**>

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.

B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

C. Notify Owner's inspecting agency at least seven days in advance of through-penetration firestop system installations; confirm dates and times on days preceding each series of installations.

D. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by[ **Owner's inspecting agency and**] building inspector, if required by authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, through-penetration firestop systems that may be incorporated into the Work include, but are not limited to, those systems indicated [**in the Through-Penetration Firestop System Schedule**] [**at the end of Part 3**] [**on Drawings**] [**.**] [**that are produced by one of the following manufacturers:**]

B. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application [**in the Through-Penetration Firestop System Schedule**] [**at the end of Part 3**] [**on Drawings**] [**.**] [**that are produced by one of the following manufacturers:**]

1. A/D Fire Protection Systems Inc.
2. Grace, W. R. & Co. - Conn.
3. Hilti, Inc.
4. Johns Manville.
5. Nelson Firestop Products.
6. NUCO Inc.
7. RectorSeal Corporation (The).
8. Specified Technologies Inc.
9. 3M; Fire Protection Products Division.
10. Tremco; Sealant/Weatherproofing Division.
11. USG Corporation.
12. <**Insert manufacturer's name.**>

## 2.2 FIRESTOPPING, GENERAL

A. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.

B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated.[ **Accessories include, but are not limited to, the following items:**]

1. Permanent forming/damming/backing materials, including the following:

    a. Slag-/rock-wool-fiber insulation.
    b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
    c. Fire-rated form board.
    d. Fillers for sealants.

2. Temporary forming materials.
3. Substrate primers.
4. Collars.
5. Steel sleeves.

## 2.3 FILL MATERIALS

A. General: Provide through-penetration firestop systems containing the types of fill materials indicated in the Through-Penetration Firestop System Schedule at the end of Part 3 by referencing the types of materials described in this Article. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill," "void," or "cavity" materials.

B. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial

extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.

C. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.

D. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

E. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.

F. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.

G. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.

H. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.

I. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives.

J. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

K. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:

1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
2. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.
3. Grade for Vertical Surfaces: Nonsag formulation for openings in vertical and other surfaces.

## 2.4 MIXING

A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with firestop system manufacturer's written instructions and with the following requirements:

1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
3. Remove laitance and form-release agents from concrete.

B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

### 3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.

B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.

C. Install fill materials for firestop systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

## 3.4 IDENTIFICATION

A. Identify through-penetration firestop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted. Include the following information on labels:

1. The words "Warning - Through-Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Through-penetration firestop system designation of applicable testing and inspecting agency.
4. Date of installation.
5. Through-penetration firestop system manufacturer's name.
6. Installer's name.

## 3.5 FIELD QUALITY CONTROL

A. Inspecting Agency: Owner will engage a qualified, independent inspecting agency to inspect through-penetration firestops. Independent inspecting agency shall comply with ASTM E 2174 requirements including those related to qualifications, conducting inspections, and preparing test reports.

B. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

## 3.6 CLEANING AND PROTECTING

A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove

damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

## 3.7 THROUGH-PENETRATION FIRESTOP SYSTEM SCHEDULE

A. Where UL-classified systems are indicated, they refer to alpha-alpha-numeric designations listed in UL's "Fire Resistance Directory" under product Category XHEZ.

B. Where OPL-classified systems are indicated, they refer to alpha-numeric design numbers in OPL's "Directory of Listed Building Products, Materials, & Assemblies."

C. Where ITS-listed systems are indicated, they refer to design numbers listed in ITS's "Directory of Listed Products," "Firestop Systems" Section.

D. Firestop Systems with No Penetrating Items[ **FS-**<**#**>]:

1. [**Available** ]UL-Classified Systems: [**C-AJ-**] [**C-BJ-**] [**F-A-**] [**W-J-**] [**W-L-**] <**Insert one or more four-digit numbers**> [**0001-0999**].
2. [**Available** ]OPL-Classified Systems: FS <**Insert one or more OPL design numbers**> [**F**] [**W**], Penetrating Item Type G.
3. [**Available** ]ITS-Listed Systems: <**Insert ITS design number(s).**>
4. Type of Fill Materials: One or more of the following:

    a. Latex sealant.
    b. Silicone sealant.
    c. Intumescent putty.
    d. Mortar.

E. Firestop Systems for Metallic Pipes, Conduit, or Tubing[ **FS-**<**#**>]:

1. [**Available** ]UL-Classified Systems: [**C-AJ-**] [**C-BJ-**] [**C-BK-**] [**F-A-**] [**F-B-**] [**F-C-**] [**W-J-**] [**W-K-**] [**W-L-**] <**Insert one or more four-digit numbers**> [**1001-1999**].
2. [**Available** ]OPL-Classified Systems: FS <**Insert one or more OPL design numbers**> [**F**] [**W**], Penetrating Item Type A.
3. [**Available** ]ITS-Listed Systems: <**Insert ITS design number(s).**>
4. Type of Fill Materials: One or more of the following:

    a. Latex sealant.
    b. Silicone sealant.
    c. Intumescent putty.
    d. Mortar.

F. Firestop Systems for Nonmetallic Pipe, Conduit, or Tubing[ **FS-**<**#**>]:

1. [**Available** ]UL-Classified Systems: [**C-AJ-**] [**C-BJ-**] [**F-A-**] [**F-B-**] [**F-C-**] [**W-J-**] [**W-L-**] <**Insert one or more four-digit numbers**> [**2001-2999**].
2. [**Available** ]OPL-Classified Systems: FS <**Insert one or more OPL design numbers**> [**F**] [**W**], Penetrating Item Type B.
3. [**Available** ]ITS-Listed Systems: <**Insert ITS design number(s).**>
4. Type of Fill Materials: One or more of the following:

a. Latex sealant.
b. Silicone sealant.
c. Intumescent putty.
d. Intumescent wrap strips.
e. Firestop device.

G. Firestop Systems for Electrical Cables[ **FS-**<#>]:

1. [**Available** ]UL-Classified Systems: [**C-AJ-**] [**C-BJ-**] [**F-A-**] [**F-B-**] [**F-C-**] [**W-J-**] [**W-L-**] <**Insert one or more four-digit numbers**> [**3001-3999**].
2. [**Available** ]OPL-Classified Systems: FS <**Insert one or more OPL design numbers**> [**F**] [**W**], Penetrating Item Type D.
3. [**Available** ]ITS-Listed Systems: <**Insert ITS design number(s).**>
4. Type of Fill Materials: One or more of the following:

a. Latex sealant.
b. Silicone sealant.
c. Intumescent putty.
d. Silicone foam.
e. Pillows/bags.

H. Firestop Systems for Cable Trays[ **FS-**<#>]:

1. [**Available** ]UL-Classified Systems: [**C-AJ-**] [**C-BJ-**] [**F-A-**] [**F-B-**] [**F-C-**] [**W-J-**] [**W-K-**] [**W-L-**] <**Insert one or more four-digit numbers**> [**4001-4999**].
2. [**Available** ]OPL-Classified Systems: FS <**Insert one or more OPL design numbers**> [**F**] [**W**], Penetrating Item Type D.
3. [**Available** ]ITS-Listed Systems: <**Insert ITS design number(s).**>
4. Type of Fill Materials: One or more of the following:

a. Latex sealant.
b. Intumescent putty.
c. Silicone foam.
d. Pillows/bags.
e. Mortar.

I. Firestop Systems for Insulated Pipes[ **FS-**<#>]:

1. [**Available** ]UL-Classified Systems: [**C-AJ-**] [**C-BJ-**] [**F-A-**] [**F-C-**] [**W-J-**] [**W-L-**] <**Insert one or more four-digit numbers**> [**5001-5999**].
2. [**Available** ]OPL-Classified Systems: FS <**Insert one or more OPL design numbers**> [**F**] [**W**], Penetrating Item Type C.
3. [**Available** ]ITS-Listed Systems: <**Insert ITS design number(s).**>
4. Type of Fill Materials: One or more of the following:

a. Latex sealant.
b. Intumescent putty.
c. Silicone foam.
d. Intumescent wrap strips.

J. Firestop Systems for Miscellaneous Electrical Penetrants[ **FS-**<#>]:

1. [**Available** ]UL-Classified Systems: [**C-AJ-**] [**F-A-**] [**W-L-**] <**Insert one or more four-digit numbers**> [**6001-6999**].
2. [**Available** ]OPL-Classified Systems: FS <**Insert one or more OPL design numbers**> [**F**] [**W**], Penetrating Item Type E.
3. [**Available** ]ITS-Listed Systems: <**Insert ITS design number(s).**>
4. Type of Fill Materials: One or more of the following:

    a. Latex sealant.
    b. Intumescent putty.
    c. Mortar.

K. Firestop Systems for Miscellaneous Mechanical Penetrants[ **FS-**<**#**>]:

1. [**Available** ]UL-Classified Systems: [**C-AJ-**] [**F-C-**] [**W-J-**] [**W-L-**] <**Insert one or more four-digit numbers**> [**7001-7999**].
2. [**Available** ]ITS-Listed Systems: <**Insert ITS design number(s).**>
3. Type of Fill Materials: One or both of the following:

    a. Latex sealant.
    b. Mortar.

L. Firestop Systems for Groupings of Penetrants[ **FS-**<**#**>]:

1. [**Available** ]UL-Classified Systems: [**C-AJ-**] [**C-BJ-**] [**F-A-**] [**F-C-**] [**W-J-**] [**W-L-**] <**Insert one or more four-digit numbers**> [**8001-8999**].
2. [**Available** ]ITS-Listed Systems: <**Insert ITS design number(s).**>
3. Type of Fill Materials: One or more of the following:

    a. Latex sealant.
    b. Mortar.
    c. Intumescent wrap strips.
    d. Firestop device.
    e. Intumescent composite sheet.

END OF SECTION 07841

**SECTION 07920 - JOINT SEALANTS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes joint sealants for the [**applications indicated in the Joint-Sealant Schedule at the end of Part 3.**] [**following applications, including those specified by reference to this Section:**] [**following applications:**]

1. Exterior joints in the following vertical surfaces and horizontal nontraffic surfaces:

a. Construction joints in cast-in-place concrete.
b. Joints between plant-precast architectural concrete units.
c. Control and expansion joints in unit masonry.
d. Joints in dimension stone cladding.
e. Joints in glass unit masonry assemblies.
f. Joints in exterior insulation and finish systems.
g. Joints between metal panels.
h. Joints between different materials listed above.
i. Perimeter joints between materials listed above and frames of [**doors**] [**windows**] [**and**] [**louvers**].
j. Control and expansion joints in [**ceilings**] [**and other**] [**overhead surfaces**].
k. <**Insert other exterior joints in vertical surfaces and horizontal nontraffic surfaces.**>
l. Other joints as indicated.

2. Exterior joints in the following horizontal traffic surfaces:

a. Control and expansion joints in brick pavers.
b. Isolation and contraction joints in cast-in-place concrete slabs.
c. Joints between plant-precast architectural concrete paving units.
d. Joints in stone paving units[**, including steps**].
e. Tile control and expansion joints.
f. Joints between different materials listed above.
g. <**Insert other exterior joints in horizontal traffic surfaces.**>
h. Other joints as indicated.

3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:

a. Control and expansion joints on exposed interior surfaces of exterior walls.
b. Perimeter joints of exterior openings where indicated.

c. Tile control and expansion joints.
d. Vertical joints on exposed surfaces of [**interior unit masonry**] [**concrete**] [**walls**] [**and**] [**partitions**].
e. Joints on underside of plant-precast structural concrete [**beams**] [**and**] [**planks**].
f. Perimeter joints between interior wall surfaces and frames of [**interior doors**] [**windows**] [**and**] [**elevator entrances**].
g. Joints between plumbing fixtures and adjoining walls, floors, and counters.
h. <**Insert other interior joints in vertical surfaces and horizontal nontraffic surfaces.**>
i. Other joints as indicated.

4. Interior joints in the following horizontal traffic surfaces:

a. Isolation joints in cast-in-place concrete slabs.
b. Control and expansion joints in stone flooring.
c. Control and expansion joints in brick flooring.
d. Control and expansion joints in tile flooring.
e. <**Insert other interior joints in horizontal traffic surfaces.**>
f. Other joints as indicated.

B. Related Sections include the following:

1. Division 1 Section "LEED Requirements" for additional LEED requirements.
2. Division 2 Section "Pavement Joint Sealants" for sealing joints in pavements, walkways, and curbing.
3. Division 4 Section "Unit Masonry Assemblies" for masonry control and expansion joint fillers and gaskets.
4. Division 7 Section "Fire-Resistive Joint Systems" for sealing joints in fire-resistance-rated construction.
5. Division 8 Section "Glazing" for glazing sealants.
6. Division 8 Section "Plastic Glazing" for plastic glazing sealants.
7. Division 8 Section "Structural-Sealant-Glazed Curtain Walls" for structural and other glazing sealants.
8. Division 9 Section "Gypsum Veneer Plaster" for sealing perimeter joints of gypsum veneer plaster partitions to reduce sound transmission.
9. Division 9 Section "Gypsum Board Assemblies" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
10. Division 9 Section "Ceramic Tile" for sealing tile joints.
11. Division 9 Section [**"Acoustical Panel Ceilings"**] [**and**] [**"Acoustical Tile Ceilings"**] for sealing edge moldings at perimeters of acoustical ceilings.
12. Division 9 Section "Chemical-Resistant Brick Flooring" for sealing flooring joints.

## 1.3 PERFORMANCE REQUIREMENTS

A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

## 1.4 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. LEED Submittals:

1. Credit EQ 4.1: Manufacturers' product data for interior sealants, including printed statement of VOC content.

E. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

F. SWRI Validation Certificate: For each elastomeric sealant specified to be validated by SWRI's Sealant Validation Program.

G. Qualification Data: For [**Installer**] [**and**] [**testing agency**].

H. Preconstruction Field Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on preconstruction testing specified in "Quality Assurance" Article.

I. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

J. Field Test Report Log: For each elastomeric sealant application.

K. Product Test Reports: Based on comprehensive testing of product formulations performed by a qualified testing agency, indicating that sealants comply with requirements.

L. Warranties: Special warranties specified in this Section.

## 1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized Installer who is approved or licensed for installation of elastomeric sealants required for this Project.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use [**ASTM C 1087**] [**manufacturer's standard test method**] to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Submit not fewer than [**eight**] <**Insert number**> pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

D. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period preceding the [**Notice to Proceed with**] [**commencement of**] the Work.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.
3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.
4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

E. Preconstruction Field-Adhesion Testing: Before installing elastomeric sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each application indicated below:

    a. Each type of elastomeric sealant and joint substrate indicated.
    b. Each type of nonelastomeric sealant and joint substrate indicated.

3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.

    a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193.

        1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

5. Report whether sealant in joint connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

F. Mockups: Build mockups incorporating sealant joints, as follows, to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:

1. Joints in mockups of assemblies specified in other Sections that are indicated to receive elastomeric joint sealants, which are specified by reference to this Section.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

## 1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer[ **or are below 40 deg F (5 deg C)**].
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

## 1.7 WARRANTY

A. Special Installer's Warranty: Installer's standard form in which Installer agrees to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: [**Two**] <**Insert number**> years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer's standard form in which elastomeric sealant manufacturer agrees to furnish elastomeric joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: <**Insert number**> years from date of Substantial Completion.

C. Special warranties specified in this Article exclude deterioration or failure of elastomeric joint sealants from the following:

1. Movement of the structure resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression caused by structural settlement or errors attributable to design or construction.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

### 2.2 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

1. Sealants: 250 g/L.
2. Sealant Primers for Nonporous Substrates: 250 g/L.
3. Sealant Primers for Porous Substrates: 775 g/L.

C. Colors of Exposed Joint Sealants: [**As indicated by manufacturer's designations**] [**Match Architect's samples**] [**As selected by Architect from manufacturer's full range**].

### 2.3 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

B. Stain-Test-Response Characteristics: Where elastomeric sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Suitability for Immersion in Liquids. Where elastomeric sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone

testing according to ASTM C 1247 and qualify for the length of exposure indicated by reference to ASTM C 920 for Class 1 or 2. Liquid used for testing sealants is deionized water, unless otherwise indicated.

D. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

E. Multicomponent Nonsag Polysulfide Sealant [**ES-**<**#**>]:

1. [**Available** ]Products:

    a. Pacific Polymers, Inc.; Elasto-Seal 227 Type II (Gun Grade).
    b. Pecora Corporation; Synthacalk GC-2+.
    c. Polymeric Systems Inc.; PSI-350.
    d. PolySpec Corp.; T-2235-M.
    e. PolySpec Corp.; T-2282.
    f. PolySpec Corp.; Thiokol 2P.
    g. Sonneborn, Division of ChemRex Inc.; Sonolastic Polysulfide Sealant.
    h. <**Insert manufacturer's name; product.**>

2. Type and Grade: M (multicomponent) and NS (nonsag).
3. Class: 25.
4. Use[**s**] Related to Exposure: [**T (traffic)**] [**NT (nontraffic)**] [**T (traffic) and NT (nontraffic)**].
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

    a. Use O Joint Substrates: [**Coated glass**] [**color anodic aluminum**] [**aluminum coated with a high-performance coating**] [**galvanized steel**] [**brick**] [**granite**] [**limestone**] [**marble**] [**ceramic tile**] [**wood**] [**and**] <**Insert other Use O substrates**>.

F. Multicomponent Nonsag Immersible Polysulfide Sealant [**ES-**<**#**>]:

1. [**Available** ]Products:

    a. Pecora Corporation; GC-2+.
    b. PolySpec Corp.; T-2235-M.
    c. <**Insert manufacturer's name; product.**>

2. Type and Grade: M (multicomponent) and NS (nonsag).
3. Class: 25.
4. Uses Related to Exposure: T (traffic), NT (nontraffic), and I (immersible), Class [**1**] [**2**].
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

    a. Use O Joint Substrates: [**Coated glass**] [**galvanized steel**] [**brick**] [**and**] <**Insert other Use O substrates**>.

G. Multicomponent Pourable Polysulfide Sealant [**ES-**<**#**>]:

1. [**Available** ]Products:

    a. Meadows, W. R., Inc.; Deck-O-Seal.
    b. Pacific Polymers, Inc.; Elastoseal 227 Type I (Pourable).
    c. <**Insert manufacturer's name; product.**>

2. Type and Grade: M (multicomponent) and P (pourable).
3. Class: 25.
4. Uses Related to Exposure: T (traffic) and NT (nontraffic).
5. Uses Related to Joint Substrates: M, [**G,**] [**A,**] and, as applicable to joint substrates indicated, O.

    a. Use O Joint Substrates: [**Brick**] [**granite**] [**limestone**] [**marble**] [**ceramic tile**] [**wood**] [**and**] <**Insert other Use O substrates**>.

H. Single-Component Nonsag Polysulfide Sealant [**ES-**<#>]:

1. [**Available** ]Products:

    a. Pacific Polymers, Inc.; Elastoseal 230 Type I (Gun Grade).
    b. Polymeric Systems Inc.; PSI-7000.
    c. <**Insert manufacturer's name; product.**>

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

    a. Use O Joint Substrates: [**Coated glass**] [**color anodic aluminum**] [**aluminum coated with a high-performance coating**] [**galvanized steel**] [**brick**] [**granite**] [**limestone**] [**marble**] [**ceramic tile**] [**wood**] [**and**] <**Insert other Use O substrates**>.

I. Multicomponent Nonsag Neutral-Curing Silicone Sealant [**ES-**<#>]:

1. [**Available** ]Products:

    a. Dow Corning Corporation; 756 H.P.
    b. <**Insert manufacturer's name; product.**>

2. Type and Grade: M (multicomponent) and P (pourable).
3. Class: 50.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

    a. Use O Joint Substrates: [**Coated glass**] [**color anodic aluminum**] [**aluminum coated with a high-performance coating**] [**galvanized steel**] [**brick**] [**limestone**] [**marble**] [**granite**] [**ceramic tile**] [**and**] <**Insert other Use O substrates**>.

J. Multicomponent Pourable Neutral-Curing Silicone Sealant [**ES-**<#>]:

1. [**Available** ]Products:

    a. Dow Corning Corporation; FC Parking Structure Sealant.
    b. <**Insert manufacturer's name; product.**>

2. Type and Grade: M (multicomponent) and P (pourable).
3. Class: 25.
4. Uses Related to Exposure: T (traffic) and NT (nontraffic).
5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.

    a. Use O Joint Substrates: [**Galvanized steel**] [**brick**] [**limestone**] [**marble**] [**granite**] [**ceramic tile**] [**and**] <**Insert other Use O substrates**>.

K. Single-Component Pourable Neutral-Curing Silicone Sealant [**ES-**<#>]:

1. [**Available** ]Products:

    a. Dow Corning Corporation; 890-SL.
    b. Pecora Corporation; 300 Pavement Sealant (Self Leveling).
    c. <**Insert manufacturer's name; product.**>
    d. Dow Corning Corporation; SL Parking Structure Sealant.
    e. <**Insert manufacturer's name; product.**>

2. Type and Grade: S (single component) and P (pourable).
3. Class: 100/50.
4. Use[**s**] Related to Exposure: NT [**and**] [**T (traffic)**].
5. Uses Related to Joint Substrates: [**M**] [**A**] [**and**] O, as applicable to joint substrates indicated.

    a. Use O Joint Substrates: [**Galvanized steel**] [**brick**] [**limestone**] [**marble**] [**granite**] [**ceramic tile**] [**and**] <**Insert other Use O substrates**>.

L. Single-Component [**Neutral- and Basic-Curing**] [**Neutral-Curing**] Silicone Sealant [**ES-**<#>]:

1. [**Available** ]Products:

    a. Dow Corning Corporation; 790.
    b. GE Silicones; SilPruf LM SCS2700.
    c. Tremco; Spectrem 1 (Basic).
    d. <**Insert manufacturer's name; product.**>
    e. GE Silicones; SilPruf SCS2000.
    f. Pecora Corporation; 864.
    g. Pecora Corporation; 890.
    h. Polymeric Systems Inc.; PSI-641.
    i. Sonneborn, Division of ChemRex Inc.; Omniseal.
    j. Tremco; Spectrem 3.
    k. <**Insert manufacturer's name; product.**>
    l. Dow Corning Corporation; 791.

m. Dow Corning Corporation; 795
n. GE Silicones; SilPruf NB SCS9000.
o. GE Silicones; UltraPruf II SCS2900.
p. Pecora Corporation; 865.
q. Pecora Corporation; 895.
r. Pecora Corporation; 898.
s. <**Insert manufacturer's name; product.**>

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: [**50**] [**100/50**].
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

    a. Use O Joint Substrates: [**Coated glass**] [**color anodic aluminum**] [**aluminum coated with a high-performance coating**] [**galvanized steel**] [**brick**] [**granite**] [**limestone**] [**marble**] [**ceramic tile**] [**wood**] [**and**] <**Insert other Use O substrates**>.

6. Stain-Test-Response Characteristics: Nonstaining to porous substrates per ASTM C 1248.

M. Single-Component Neutral-Curing Silicone Sealant [**ES-**<#>]:

1. [**Available** ]Products:

    a. Dow Corning Corporation; 799.
    b. GE Silicones; UltraGlaze SSG4000.
    c. GE Silicones; UltraGlaze SSG4000AC.
    d. Polymeric Systems Inc.; PSI-631.
    e. Schnee-Morehead, Inc.; SM5731 Poly-Glaze Plus.
    f. Tremco; Proglaze SG.
    g. Tremco; Spectrem 2.
    h. Tremco; Tremsil 600.
    i. <**Insert manufacturer's name; product.**>

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: [**M,** ]G, A, and, as applicable to joint substrates indicated, O.

    a. Use O Joint Substrates: [**Coated glass**] [**color anodic aluminum**] [**aluminum coated with a high-performance coating**] [**galvanized steel**] [**ceramic tile**] [**and**] <**Insert other Use O substrates**>.

N. Single-Component Acid-Curing Silicone Sealant [**ES-**<#>]:

1. [**Available** ]Products:

    a. Bostik Findley; Chem-Calk 1200.

b. Dow Corning Corporation; 999-A.
c. Dow Corning Corporation; Trademate Glazing.
d. GE Silicones; Construction SCS1200.
e. GE Silicones; Contractors SCS1000.
f. GE Silicones; Sanitary SCS1700.
g. Pecora Corporation; 860.
h. Polymeric Systems Inc.; PSI-601.
i. Polymeric Systems Inc.; PSI-613.
j. Schnee-Morehead, Inc.; SM5732 Polyglaze.
k. Sonneborn, Division of ChemRex Inc.; OmniPlus.
l. Tremco; Proglaze.
m. Tremco; Tremsil 200.
n. <**Insert manufacturer's name; product.**>

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.

a. Use O Joint Substrates: [**Coated glass**] [**color anodic aluminum**] [**aluminum coated with a high-performance coating**] [**galvanized steel**] [**ceramic tile**] [**and**] <**Insert other Use O substrates**>.

O. Single-Component Mildew-Resistant Neutral-Curing Silicone Sealant[**ES-**<**#**>]:

1. [**Available** ]Products:

a. Pecora Corporation; 898.
b. Tremco; Tremsil 600 White.
c. <**Insert manufacturer's name; product.**>

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: [**M,** ]G, A, and, as applicable to joint substrates indicated, O.

a. Use O Joint Substrates: [**Coated glass**] [**color anodic aluminum**] [**aluminum coated with a high-performance coating**] [**galvanized steel**] [**ceramic tile**] [**and**] <**Insert other Use O substrates**>.

P. Single-Component Mildew-Resistant Acid-Curing Silicone Sealant [**ES-**<**#**>]:

1. [**Available** ]Products:

a. Dow Corning Corporation; 786 Mildew Resistant.
b. GE Silicones; Sanitary SCS1700.
c. Tremco; Tremsil 200 [**White**] [**Clear**].
d. <**Insert manufacturer's name; product.**>

2. Type and Grade: S (single component) and NS (nonsag).

3. Class: 25.
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: G, A, and, as applicable to joint substrates indicated, O.

    a. Use O Joint Substrates: [**Coated glass**] [**color anodic aluminum**] [**aluminum coated with a high-performance coating**] [**ceramic tile**] [**and**] <**Insert other Use O substrates**>.

Q. Multicomponent Nonsag Urethane Sealant [**ES-**<**#**>]:

1. [**Available** ]Products:

    a. Pecora Corporation; Dynatrol II.
    b. Tremco; Dymeric 511.
    c. Tremco; Vulkem 922.
    d. <**Insert manufacturer's name; product.**>

2. Type and Grade: M (multicomponent) and NS (nonsag).
3. Class: 50.
4. Use[**s**] Related to Exposure: NT (nontraffic) [**and**] [**T (traffic)**].
5. Uses Related to Joint Substrates: M, [**G,** ]A, and, as applicable to joint substrates indicated, O.

    a. Use O Joint Substrates: [**Color anodic aluminum**] [**aluminum coated with a high-performance coating**] [**galvanized steel**] [**brick**] [**granite**] [**limestone**] [**marble**] [**ceramic tile**] [**wood**] [**and**] <**Insert other Use O substrates**>.

R. Multicomponent Nonsag Urethane Sealant [**ES-**<**#**>]:

1. [**Available** ]Products:

    a. Schnee-Morehead, Inc.; Permathane SM 7200.
    b. Sika Corporation, Inc.; Sikaflex - 2c NS TG.
    c. Sonneborn, Division of ChemRex Inc.; NP 2.
    d. Tremco; Vulkem 227.
    e. Tremco; Vulkem 322 DS.
    f. <**Insert manufacturer's name; product.**>

2. Type and Grade: M (multicomponent) and NS (nonsag).
3. Class: 25.
4. Uses Related to Exposure: T (traffic) and NT (nontraffic).
5. Uses Related to Joint Substrates: M, [**G,** ]A, and, as applicable to joint substrates indicated, O.

    a. Use O Joint Substrates: [**Color anodic aluminum**] [**aluminum coated with a high-performance coating**] [**galvanized steel**] [**brick**] [**granite**] [**limestone**] [**marble**] [**ceramic tile**] [**wood**] [**and**] <**Insert other Use O substrates**>.

S. Multicomponent Nonsag Urethane Sealant [**ES-**<**#**>]:

1. [**Available** ]Products:

a. Bostik Findley; Chem-Calk 500.
b. Pacific Polymers, Inc.; Elasto-Thane 227 R Type II (Gun Grade).
c. Polymeric Systems Inc.; PSI-270.
d. Tremco; Dymeric.
e. <**Insert manufacturer's name; product.**>

2. Type and Grade: M (multicomponent) and NS (nonsag).
3. Class: 25.
4. Additional Movement Capability: 40 percent movement in extension and 25 percent in compression for a total of 65 percent movement.
5. Use Related to Exposure: NT (nontraffic).
6. Uses Related to Joint Substrates: M, [**G,** ]A, and, as applicable to joint substrates indicated, O.

a. Use O Joint Substrates: [**Galvanized steel**] [**brick**] [**granite**] [**marble**] [**ceramic tile**] [**wood**] [**and**] <**Insert other Use O substrates**>.

T. Multicomponent Nonsag Urethane Sealant [**ES-**<**#**>]:

1. [**Available** ]Products:

a. Pacific Polymers, Inc.; Elasto-Thane 227 High Shore Type II (Gun Grade).
b. Pacific Polymers, Inc.; Elasto-Thane 227 Type II (Gun Grade).
c. Pecora Corporation; Dynatred.
d. Polymeric Systems Inc.; PSI-270.
e. <**Insert manufacturer's name; product.**>

2. Type and Grade: M (multicomponent) and NS (nonsag).
3. Class: 25.
4. Use Related to Exposure: T (traffic).
5. Uses Related to Joint Substrates: M, [**G,** ]A, and, as applicable to joint substrates indicated, O.

a. Use O Joint Substrates: [**Galvanized steel**] [**brick**] [**granite**] [**marble**] [**ceramic tile**] [**and**] <**Insert other Use O substrates**>.

U. Multicomponent Nonsag Immersible Urethane Sealant [**ES-**<**#**>]:

1. [**Available** ]Products:

a. Pacific Polymers, Inc.; Elasto-Thane 227 R Type II (Gun Grade).
b. Pecora Corporation; Dynatred.
c. Tremco; Vulkem 227.
d. Tremco; Vulkem 322 DS.
e. <**Insert manufacturer's name; product.**>

2. Type and Grade: M (multicomponent) and NS (nonsag).
3. Class: 25.
4. Use[**s**] Related to Exposure: [**T (traffic)**] [**NT (nontraffic)**] and I (immersible), Class [**1**] [**2**].

5. Uses Related to Joint Substrates: M, [**G,** ]A, and, as applicable to joint substrates indicated, O.

    a. Use O Joint Substrates: [**Color anodic aluminum**] [**aluminum coated with a high-performance coating**] [**galvanized steel**] [**brick**] [**granite**] [**marble**] [**ceramic tile**] [**wood**] [**and**] <**Insert other Use O substrates**>.

V. Multicomponent Pourable Urethane Sealant [**ES-**<#>]:

1. [**Available** ]Products:

    a. Bostik Findley; Chem-Calk 550.
    b. Meadows, W. R., Inc.; POURTHANE.
    c. Pacific Polymers, Inc.; Elasto-Thane 227 High Shore Type I (Self Leveling).
    d. Pacific Polymers, Inc.; Elasto-Thane 227 Type I (Self Leveling).
    e. Pecora Corporation; Urexpan NR-200.
    f. Polymeric Systems Inc.; PSI-270SL.
    g. Schnee-Morehead, Inc.; Permathane SM 7201.
    h. Tremco; THC-901.
    i. Tremco; THC-900.
    j. Tremco; Vulkem 245.
    k. Pecora Corporation; Urexpan NR 300, Type H.
    l. Pecora Corporation; Urexpan NR 300, Type M.
    m. <**Insert manufacturer's name; product.**>

2. Type and Grade: M (multicomponent) and P (pourable).
3. Class: [**25**] [**12-1/2**].
4. Use Related to Exposure: T (traffic).
5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.

    a. Use O Joint Substrates: [**Color anodic aluminum**] [**aluminum coated with a high-performance coating**] [**galvanized steel**] [**brick**] [**granite**] [**marble**] [**ceramic tile**] [**wood**] [**and**] <**Insert other Use O substrates**>.

W. Multicomponent Pourable Urethane Sealant [**ES-**<#>]:

1. [**Available** ]Products:

    a. Pecora Corporation; Dynatrol II-SG.
    b. Sika Corporation, Inc.; Sikaflex - 2c SL.
    c. Sonneborn, Division of ChemRex Inc.; SL 2.
    d. <**Insert manufacturer's name; product.**>

2. Type and Grade: M (multicomponent) and P (pourable).
3. Class: [**25**] [**50**].
4. Uses Related to Exposure: T (traffic) and NT (nontraffic).
5. Uses Related to Joint Substrates: M, G, A, and, as applicable to joint substrates indicated, O.

a. Use O Joint Substrates: [**Color anodic aluminum**] [**aluminum coated with a high-performance coating**] [**galvanized steel**] [**brick**] [**granite**] [**marble**] [**ceramic tile**] [**wood**] [**and**] <**Insert other Use O substrates**>.

X. Multicomponent Pourable Immersible Urethane Sealant [**ES-**<**#**>]:

1. [**Available** ]Products:

a. Pacific Polymers, Inc.; Elasto-Thane 227 R Type II (Self Leveling).
b. Tremco; Vulkem 245.
c. <**Insert manufacturer's name; product.**>

2. Type and Grade: M (multicomponent) and P (pourable).
3. Class: 25.
4. Uses Related to Exposure: [**T (traffic)**] [**NT (nontraffic)**] and I (immersible), Class [**1**] [**2**].
5. Uses Related to Joint Substrates: M, [**G,** ]A, and, as applicable to joint substrates indicated, O.

a. Use O Joint Substrates: [**Brick**] [**wood**] [**and**] <**Insert other Use O substrates**>.

Y. Single-Component Nonsag Urethane Sealant [**ES-**<**#**>]:

1. [**Available** ]Products:

a. Sika Corporation, Inc.; Sikaflex - 1a.
b. Sonneborn, Division of ChemRex Inc.; Ultra.
c. Sonneborn, Division of ChemRex Inc.; NP 1.
d. Tremco; Vulkem 116.
e. <**Insert manufacturer's name; product.**>

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: 25.
4. Uses Related to Exposure: T (traffic) and NT (nontraffic).
5. Uses Related to Joint Substrates: M, [**G,** ]A, and, as applicable to joint substrates indicated, O.

a. Use O Joint Substrates: [**Color anodic aluminum**] [**aluminum coated with a high-performance coating**] [**galvanized steel**] [**brick**] [**granite**] [**marble**] [**ceramic tile**] [**wood**] [**and**] <**Insert other Use O substrates**>.

Z. Single-Component Nonsag Urethane Sealant [**ES-**<**#**>]:

1. [**Available** ]Products:

a. Bostik Findley; Chem-Calk 900.
b. Bostik Findley; Chem-Calk 915.
c. Bostik Findley; Chem-Calk 916 Textured.
d. Bostik Findley; Chem-Calk 2639.
e. Pecora Corporation; Dynatrol I-XL.
f. Polymeric Systems Inc.; Flexiprene 1000.

g. Polymeric Systems Inc.; PSI-901.
h. Schnee-Morehead, Inc.; Permathane SM7100.
i. Schnee-Morehead, Inc.; Permathane SM7108.
j. Schnee-Morehead, Inc.; Permathane SM7110.
k. Sika Corporation, Inc.; Sikaflex - 15LM.
l. Tremco; DyMonic.
m. Tremco; Vulkem 921.
n. Tremco; Vulkem 931.
o. <**Insert manufacturer's name; product.**>

2. Type and Grade: S (single component) and NS (nonsag).
3. Class: [**25**] [**50**] [**100/50**].
4. Use Related to Exposure: NT (nontraffic).
5. Uses Related to Joint Substrates: M, [**G,** ]A, and, as applicable to joint substrates indicated, O.

a. Use O Joint Substrates: [**Color anodic aluminum**] [**aluminum coated with a high-performance coating**] [**galvanized steel**] [**brick**] [**granite**] [**marble**] [**ceramic tile**] [**wood**] [**and**] <**Insert other Use O substrates**>.

AA. Multicomponent Nonsag Immersible Urethane Sealant [**ES-**<**#**>]:

1. [**Available** ]Products:

a. Tremco; Vulkem 116.
b. Tremco; Vulkem 921.
c. <**Insert manufacturer's name; product.**>

2. Type and Grade: M (multicomponent) and P (pourable).
3. Class: [**25**] [**50**].
4. Uses Related to Exposure: [**T (traffic) and NT (nontraffic)**] [**NT (nontraffic)**] and I (immersible), Class [**1**] [**2**].
5. Uses Related to Joint Substrates: M, A, and, as applicable to joint substrates indicated, O.

a. Use O Joint Substrates: [**Color anodic aluminum**] [**aluminum coated with a high-performance coating**] [**galvanized steel**] [**brick**] [**granite**] [**marble**] [**ceramic tile**] [**wood**] [**and**] <**Insert other Use O substrates**>.

BB. Single-Component Pourable Urethane Sealant [**ES-**<**#**>]:

1. [**Available** ]Products:

a. Sika Corporation, Inc.; Sikaflex - 1CSL.
b. Sonneborn, Division of ChemRex Inc.; SL 1.
c. Tremco; Vulkem Nova 300 SSL.
d. <**Insert manufacturer's name; product.**>

2. Type and Grade: S (single component) and P (pourable).
3. Class: [**25**] [**50**].
4. Uses Related to Exposure: T (traffic) and NT (nontraffic).

5. Uses Related to Joint Substrates: M, [**G,** ]A, and, as applicable to joint substrates indicated, O.

    a. Use O Joint Substrates: [**Galvanized steel**] [**brick**] [**granite**] [**marble**] [**ceramic tile**] [**wood**] [**and**] <**Insert other Use O substrates**>.

CC. Single-Component Pourable Urethane Sealant [**ES-**<**#**>]:

1. [**Available** ]Products:

    a. Bostik Findley; Chem-Calk 950.
    b. Pecora Corporation; Urexpan NR-201.
    c. Polymeric Systems Inc.; Flexiprene 952.
    d. Schnee-Morehead, Inc.; Permathane SM7101.
    e. Tremco; Tremflex S/L.
    f. Tremco; Vulkem 45.
    g. <**Insert manufacturer's name; product.**>

2. Type and Grade: S (single component) and P (pourable).
3. Class: 25.
4. Use Related to Exposure: T (traffic).
5. Uses Related to Joint Substrates: M, [**G,** ]A, and, as applicable to joint substrates indicated, O.

    a. Use O Joint Substrates: [**Color anodic aluminum**] [**aluminum coated with a high-performance coating**] [**galvanized steel**] [**brick**] [**granite**] [**marble**] [**ceramic tile**] [**wood**] [**and**] <**Insert other Use O substrates**>.

## 2.4 SOLVENT-RELEASE JOINT SEALANTS

A. Acrylic-Based Solvent-Release Joint Sealant [**SRS-**<**#**>]: Comply with ASTM C 1311 or FS TT-S-00230.

1. [**Available** ]Products:

    a. Schnee-Moorehead, Inc.; Acryl-R Acrylic Sealant.
    b. Tremco; Mono 555.
    c. <**Insert manufacturer's name; product.**>

B. Butyl-Rubber-Based Solvent-Release Joint Sealant [**SRS-**<**#**>]: Comply with ASTM C 1085.

1. [**Available** ]Products:

    a. Bostik Findley; Bostik 300.
    b. Fuller, H. B. Company; SC-0296.
    c. Fuller, H. B. Company; SC-0288.
    d. Pecora Corporation; BC-158.
    e. Polymeric Systems Inc.; PSI-301
    f. Sonneborn, Division of ChemRex Inc.; Sonneborn Multi-Purpose Sealant.
    g. Tremco; Tremco Butyl Sealant.

h. <**Insert manufacturer's name; product.**>

C. Pigmented Narrow-Joint Sealant [**SRS-**<#>]: Manufacturer's standard, solvent-release-curing, pigmented, synthetic-rubber sealant complying with AAMA 803.3 and formulated for sealing joints 3/16 inch (5 mm) or smaller in width.

1. [**Available** ]Products:

a. Fuller, H. B. Company; SC-0289.
b. Schnee-Morehead, Inc.; SM 5504 Acryl-R Narrow Joint Sealant.
c. <**Insert manufacturer's name; product.**>

## 2.5 LATEX JOINT SEALANTS

A. Latex Sealant [**LS-**<#>]: Comply with ASTM C 834, Type P, Grade NF.

B. [**Available** ]Products:

1. Bostik Findley; Chem-Calk 600.
2. Pecora Corporation; AC-20+.
3. Schnee-Morehead, Inc.; SM 8200.
4. Sonneborn, Division of ChemRex Inc.; Sonolac.
5. Tremco; Tremflex 834.
6. <**Insert manufacturer's name; product.**>

## 2.6 ACOUSTICAL JOINT SEALANTS

A. Acoustical Sealant for Exposed and Concealed Joints [**AS-**<#>]: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following:

1. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
2. [**Available** ]Products:

a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
c. <**Insert manufacturer's name; product.**>

B. Acoustical Sealant for Concealed Joints [**AS-**<#>]: Manufacturer's standard, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant recommended for sealing interior concealed joints to reduce airborne sound transmission.

1. [**Available** ]Products:

a. Pecora Corporation; BA-98.
b. Tremco; Tremco Acoustical Sealant.
c. <**Insert manufacturer's name; product.**>

## 2.7 PREFORMED JOINT SEALANTS

A. Preformed Silicone-Sealant System [**PS-**<#>]: Manufacturer's standard system consisting of precured low-modulus silicone extrusion, in sizes to fit joint widths indicated, combined with a neutral-curing silicone sealant for bonding extrusions to substrates.

1. [**Available** ]Products:

    a. Dow Corning Corporation; 123 Silicone Seal.
    b. GE Silicones; UltraSpan US1100.
    c. Pecora Corporation; Sil-Span.
    d. Tremco; Spectrem Ez Seal.
    e. <**Insert manufacturer's name; product.**>

B. Preformed Foam Sealant [**PS-**<#>]: Manufacturer's standard preformed, precompressed, open-cell foam sealant that is manufactured from high-density urethane foam impregnated with a nondrying, water-repellent agent; is factory produced in precompressed sizes in roll or stick form to fit joint widths indicated; is coated on one side with a pressure-sensitive adhesive and covered with protective wrapping; develops a watertight and airtight seal when compressed to the degree specified by manufacturer; and complies with the following:

1. [**Available** ]Products:

    a. EMSEAL Joint Systems, Ltd.; Emseal 25V.
    b. illbruck Sealant Systems, Inc.; Wilseal 600.
    c. Polytite Manufacturing Corporation; Polytite B.
    d. Polytite Manufacturing Corporation; Polytite Standard.
    e. Sandell Manufacturing Co., Inc.; Polyseal.
    f. <**Insert manufacturer's name; product.**>

2. Properties: Permanently elastic, mildew resistant, nonmigratory, nonstaining, and compatible with joint substrates and other joint sealants.

    a. Density: [**Manufacturer's standard**] [**5.5 to 6.5 lb/cu. ft. (90 to 110 kg/cu. m)**] [**10 lb/cu. ft. (160 kg/cu. m)**].

## 2.8 PREFORMED TAPE SEALANTS

A. Back-Bedding Mastic Tape Sealant: Preformed, butyl-based elastomeric tape sealant with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
2. AAMA 806.3 tape, for applications in which tape is subject to continuous pressure.
3. AAMA 807.3 tape, for applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Tape Sealant: Closed-cell, PVC foam tape sealant; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:

1. Type 1, for applications in which tape acts as the primary sealant.
2. Type 2, for applications in which tape is used in combination with a full bead of liquid sealant.

## 2.9 JOINT-SEALANT BACKING

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type [**C (closed-cell material with a surface skin)**] [**O (open-cell material)**] [**B (bicellular material with a surface skin)**][ **or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated**], and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F (minus 32 deg C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and to otherwise contribute to optimum sealant performance.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

## 2.10 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.
    d. <**Insert other porous joint substrate.**>

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.
    e. <**Insert other nonporous joint substrate.**>

B. Joint Priming: Prime joint substrates[**, where recommended in writing by joint-sealant manufacturer,**] based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by

cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

## 3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Acoustical Sealant Application Standard: Comply with recommendations in ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

D. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

F. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
4. Provide flush joint configuration where indicated per Figure 5B in ASTM C 1193.
5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 5C in ASTM C 1193.

    a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

H. Installation of Preformed Tapes: Install according to manufacturer's written instructions.

I. Installation of Preformed Silicone-Sealant System: Comply with the following requirements:

1. Apply masking tape to each side of joint, outside of area to be covered by sealant system.
2. Apply silicone sealant to each side of joint to produce a bead of size complying with preformed silicone-sealant system manufacturer's written instructions and covering a bonding area of not less than 3/8 inch (10 mm). Hold edge of sealant bead 1/4 inch (6 mm) inside masking tape.
3. Within 10 minutes of sealant application, press silicone extrusion into sealant to wet extrusion and substrate. Use a roller to apply consistent pressure and ensure uniform contact between sealant and both extrusion and substrate.
4. Complete installation of sealant system in horizontal joints before installing in vertical joints. Lap vertical joints over horizontal joints. At ends of joints, cut silicone extrusion with a razor knife.

J. Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, producing seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in compliance with sealant manufacturer's written instructions.

## 3.4 FIELD QUALITY CONTROL

A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

1. Extent of Testing: Test completed elastomeric sealant joints as follows:

a. Perform [**10**] <**Insert number**> tests for the first [**1000 feet (300 m)**] <**Insert dimension**> of joint length for each type of elastomeric sealant and joint substrate.
b. Perform 1 test for each [**1000 feet (300 m)**] <**Insert dimension**> of joint length thereafter or 1 test per each floor per elevation.

2. Test Method: Test joint sealants according to [**Method A, Field-Applied Sealant Joint Hand Pull Tab**] [**Method B, Exposed Surface Finish Hand Pull Tab**] [**Method C, Field-Applied Sealant Joint Hand Pull Flap**] [**or**] [**Method D, Water Immersion**] in Appendix X1 in ASTM C 1193[**, as appropriate for type of joint-sealant application indicated**].

a. For joints with dissimilar substrates, verify adhesion to each substrate separately; do this by extending cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

3. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field-adhesion-test log.
4. Inspect tested joints and report on the following:

a. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type

of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field-adhesion hand-pull test criteria.

b. Whether sealants filled joint cavities and are free of voids.

c. Whether sealant dimensions and configurations comply with specified requirements.

5. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.

6. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

B. Evaluation of Field Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

## 3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

## 3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

## 3.7 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application JS-[#]: Exterior vertical[ **and horizontal nontraffic**] construction joints in cast-in-place concrete.

1. Joint Sealant: [**Multicomponent nonsag polysulfide sealant**] [**Single-component nonsag polysulfide sealant**] [**Multicomponent nonsag neutral-curing silicone sealant**] [**Single-component neutral- and basic-curing silicone sealant**] [**Single-component neutral-curing silicone sealant**] [**Multicomponent nonsag urethane sealant**] [**Multicomponent nonsag immersible urethane sealant**] [**Single-component nonsag urethane sealant**] <**Insert joint sealant**> [**ES-**<**#**>].

2. Joint-Sealant Color: [**As selected by Architect from manufacturer's full range**] <**Insert color**> <**Insert color designation of one of the joint-sealant products named in Part 2**>.

B. Joint-Sealant Application JS-[#]: Exterior horizontal [**nontraffic**] [**and**] [**traffic**] [**isolation**] [**and**] [**contraction**] joints in cast-in-place concrete slabs.

1. Joint Sealant: [**Multicomponent pourable polysulfide sealant**] [**Single-component pourable neutral-curing silicone sealant**] [**Multicomponent nonsag urethane sealant**] [**Multicomponent pourable urethane sealant**] [**Multicomponent pourable immersible urethane sealant**] [**Single-component pourable urethane sealant**] <**Insert joint sealant**> [**ES-**<#>].
2. Joint-Sealant Color: [**As selected by Architect from manufacturer's full range**] <**Insert color**> <**Insert color designation of one of the joint-sealant products named in Part 2**>.

C. Joint-Sealant Application JS-[#]: Exterior vertical[ **and horizontal nontraffic**] joints between plant-precast architectural concrete units.

1. Joint Sealant: [**Multicomponent nonsag polysulfide sealant**] [**Single-component nonsag polysulfide sealant**] [**Single-component neutral- and basic-curing silicone sealant**] [**Multicomponent nonsag neutral-curing silicone sealant**] [**Single-component neutral-curing silicone sealant**] [**Multicomponent nonsag urethane sealant**] [**Single-component nonsag urethane sealant**] <**Insert joint sealant**> [**ES-**<#>].
2. Joint-Sealant Color: [**As selected by Architect from manufacturer's full range**] <**Insert color**> <**Insert color designation of one of the joint-sealant products named in Part 2**>.

D. Joint-Sealant Application JS-[#]: Exterior vertical control and expansion joints in unit masonry.

1. Joint Sealant: [**Multicomponent nonsag polysulfide sealant**] [**Single-component nonsag polysulfide sealant**] [**Single-component neutral- and basic-curing silicone sealant**] [**Single-component neutral-curing silicone sealant**] [**Multicomponent nonsag urethane sealant**] [**Single-component nonsag urethane sealant**] <**Insert joint sealant**> [**ES-**<#>].
2. Joint-Sealant Color: [**As selected by Architect from manufacturer's full range**] <**Insert color**> <**Insert color designation of one of the joint-sealant products named in Part 2**>.

E. Joint-Sealant Application JS-[#]: Exterior joints in dimension stone cladding.

1. Joint Sealant: [**Multicomponent nonsag polysulfide sealant**] [**Single-component nonsag polysulfide sealant**] [**Multicomponent nonsag neutral-curing silicone sealant**] [**Single-component neutral- and basic-curing silicone sealant**] [**Single-component neutral-curing silicone sealant**] [**Multicomponent nonsag urethane sealant**] <**Insert joint sealant**> [**ES-**<#>].
2. Joint-Sealant Color: [**As selected by Architect from manufacturer's full range**] <**Insert color**> <**Insert color designation of one of the joint-sealant products named in Part 2**>.

F. Joint-Sealant Application JS-[#]: Interior and exterior sealant-pointed mortar joints in glass unit masonry assemblies.

1. Joint Sealant: [**Single-component neutral-curing silicone sealant**] [**Single-component acid-curing silicone sealant**] <**Insert joint sealant**> [**ES-**<#>].

2. Joint-Sealant Color: [**As selected by Architect from manufacturer's full range**] <**Insert color**> <**Insert color designation of one of the joint-sealant products named in Part 2**>.

G. Joint-Sealant Application JS-[#]: Exterior joints in exterior insulation and finish systems.

1. Joint Sealant: [**Single-component neutral- and basic-curing silicone sealant**] [**Single-component neutral-curing silicone sealant**] [**Multicomponent nonsag urethane sealant**] <**Insert joint sealant**> [**ES-**<#>] [**Preformed silicone-sealant system**].
2. Joint-Sealant Color: [**As selected by Architect from manufacturer's full range**] <**Insert color**> <**Insert color designation of one of the joint-sealant products named in Part 2**>.

H. Joint-Sealant Application JS-[#]: Exterior butt joints between metal panels.

1. Joint Sealant: [**Single-component neutral- and basic-curing silicone sealant**] [**Single-component neutral-curing silicone sealant**] [**Multicomponent nonsag urethane sealant**] [**Single-component nonsag urethane sealant**] <**Insert joint sealant**> [**ES-**<#>].
2. Joint-Sealant Color: [**As selected by Architect from manufacturer's full range**] <**Insert color**> <**Insert color designation of one of the joint-sealant products named in Part 2**>.

I. Joint-Sealant Application JS-[#]: Exterior vertical joints between[ **different materials listed above**] <**Insert materials**>.

1. Joint Sealant: [**Multicomponent nonsag polysulfide sealant**] [**Single-component nonsag polysulfide sealant**] [**Single-component neutral- and basic-curing silicone sealant**] [**Single-component neutral-curing silicone sealant**] [**Multicomponent nonsag urethane sealant**] [**Single-component nonsag urethane sealant**] <**Insert joint sealant**> [**ES-**<#>].
2. Joint-Sealant Color: [**As selected by Architect from manufacturer's full range**] <**Insert color**> <**Insert color designation of one of the joint-sealant products named in Part 2**>.

J. Joint-Sealant Application JS-[#]: Exterior perimeter joints between <**Insert material**> and frames of [**doors**] [**windows**] [**and**] [**louvers**].

1. Joint Sealant: [**Multicomponent nonsag polysulfide sealant**] [**Single-component nonsag polysulfide sealant**] [**Single-component neutral- and basic-curing silicone sealant**] [**Single-component neutral-curing silicone sealant**] [**Multicomponent nonsag urethane sealant**] [**Single-component nonsag urethane sealant**] <**Insert joint sealant**> [**ES-**<#>].
2. Joint-Sealant Color: [**As selected by Architect from manufacturer's full range**] <**Insert color**> <**Insert color designation of one of the joint-sealant products named in Part 2**>.

K. Joint-Sealant Application JS-[#]: Exterior control and expansion joints in [**ceilings**] [**and other**] [**overhead surfaces**].

1. Joint Sealant: [**Multicomponent nonsag polysulfide sealant**] [**Single-component nonsag polysulfide sealant**] [**Single-component neutral- and basic-curing silicone sealant**] [**Single-component neutral-curing silicone sealant**] [**Multicomponent nonsag urethane sealant**] [**Single-component nonsag urethane sealant**] <**Insert joint sealant**> [**ES-**<#>].
2. Joint-Sealant Color: [**As selected by Architect from manufacturer's full range**] <**Insert color**> <**Insert color designation of one of the joint-sealant products named in Part 2**>.

L. Joint-Sealant Application JS-[#]: <**Insert other exterior joints in vertical and horizontal nontraffic surfaces.**>

1. Joint Sealant: [**Multicomponent nonsag polysulfide sealant**] [**Single-component nonsag polysulfide sealant**] [**Single-component neutral- and basic-curing silicone sealant**] [**Single-component neutral-curing silicone sealant**] [**Multicomponent nonsag urethane sealant**] [**Single-component nonsag urethane sealant**] <**Insert joint sealant**> [**ES-**<#>].
2. Joint-Sealant Color: [**As selected by Architect from manufacturer's full range**] <**Insert color**> <**Insert color designation of one of the joint-sealant products named in Part 2**>.

M. Joint-Sealant Application JS-[#]: Exterior control and expansion joints in horizontal traffic surfaces of [**brick pavers**] [**ceramic tile**] [**stone paving units**] <**Insert material**>.

1. Joint Sealant: [**Multicomponent pourable polysulfide sealant**] [**Multicomponent nonsag urethane sealant**] [**Multicomponent pourable urethane sealant**] [**Single-component pourable urethane sealant**] <**Insert joint sealant**> [**ES-**<#>].
2. Joint-Sealant Color: [**As selected by Architect from manufacturer's full range**] <**Insert color**> <**Insert color designation of one of the joint-sealant products named in Part 2**>.

N. Joint-Sealant Application JS-[#]: Vertical control and expansion joints on exposed interior surfaces of exterior walls.

1. Joint Sealant: [**Multicomponent nonsag polysulfide sealant**] [**Single-component nonsag polysulfide sealant**] [**Single-component neutral- and basic-curing silicone sealant**] [**Single-component neutral-curing silicone sealant**] [**Multicomponent nonsag urethane sealant**] [**Single-component nonsag urethane sealant**] <**Insert joint sealant**> [**ES-**<#>] [**Latex sealant**].
2. Joint-Sealant Color: [**As selected by Architect from manufacturer's full range**] <**Insert color**> <**Insert color designation of one of the joint-sealant products named in Part 2**>.

O. Joint-Sealant Application JS-[#]: Interior perimeter joints of exterior openings.

1. Joint Sealant: [**Multicomponent nonsag polysulfide sealant**] [**Single-component nonsag polysulfide sealant**] [**Single-component neutral- and basic-curing silicone sealant**] [**Single-component neutral-curing silicone sealant**] [**Multicomponent nonsag urethane sealant**] [**Single-component nonsag urethane sealant**] <**Insert joint sealant**> [**ES-**<#>] [**Latex sealant**].

2. Joint-Sealant Color: [**As selected by Architect from manufacturer's full range**] <**Insert color**> <**Insert color designation of one of the joint-sealant products named in Part 2**>.

P. Joint-Sealant Application JS-[#]: Interior [**ceramic**] [**dimension stone**] tile expansion, control, contraction, and isolation joints in horizontal traffic surfaces.

1. Joint Sealant: [**Multicomponent pourable polysulfide sealant**] [**Multicomponent nonsag urethane sealant**] [**Multicomponent pourable urethane sealant**] [**Single-component pourable urethane sealant**] <**Insert joint sealant**> [**ES-**<#>].
2. Joint-Sealant Color: [**As selected by Architect from manufacturer's full range**] <**Insert color**> <**Insert color designation of one of the joint-sealant products named in Part 2**>.

Q. Joint-Sealant Application JS-[#]: Interior joints between plumbing fixtures and adjoining walls, floors, and counters.

1. Joint Sealant: Single-component mildew-resistant [**neutral**] [**acid**]-curing silicone sealant[ **ES-**<#>].
2. Joint-Sealant Color: [**White**] [**As selected by Architect from manufacturer's full range**] <**Insert color**> <**Insert color designation of one of the joint-sealant products named in Part 2**>.

R. Joint-Sealant Application JS-[#]: Vertical joints on exposed surfaces of interior [**unit masonry**] [**and**] [**concrete**] [**walls**] [**and**] [**partitions**].

1. Joint Sealant: [**Multicomponent nonsag polysulfide sealant**] [**Single-component nonsag polysulfide sealant**] [**Single-component neutral- and basic-curing silicone sealant**] [**Single-component neutral-curing silicone sealant**] [**Multicomponent nonsag urethane sealant**] [**Single-component nonsag urethane sealant**] <**Insert joint sealant**> [**ES-**<#>] [**Latex sealant**].
2. Joint-Sealant Color: [**White**] [**As selected by Architect from manufacturer's full range**] <**Insert color**> <**Insert color designation of one of the joint-sealant products named in Part 2**>.

S. Joint-Sealant Application JS-[#]: Perimeter joints between interior wall surfaces and frames of [**interior doors**] [**windows**] [**and**] [**elevator entrances**].

1. Joint Sealant: [**Latex sealant**] <**Insert joint sealant**>.
2. Joint-Sealant Color: [**As selected by Architect from manufacturer's full range**] <**Insert color**> <**Insert color designation of one of the joint-sealant products named in Part 2**>.

T. Joint-Sealant Application JS-[#]: Interior control, expansion, and isolation joints in horizontal traffic surfaces of [**dimension stone**] [**brick**] flooring [**and**] <**Insert other interior joints in horizontal traffic surfaces**>.

1. Joint Sealant: [**Multicomponent pourable polysulfide sealant**] [**Multicomponent nonsag urethane sealant**] [**Multicomponent pourable urethane sealant**] [**Single-component pourable urethane sealant**] <**Insert joint sealant**> [**ES-**<#>].

2. Joint-Sealant Color: [**As selected by Architect from manufacturer's full range**] <**Insert color**> <**Insert color designation of one of the joint-sealant products named in Part 2**>.

U. Joint-Sealant Application JS-[#]: <**Insert other interior joints in horizontal traffic surfaces**>.

1. Joint Sealant: <**Insert joint sealant**> [**ES-**<#>].
2. Joint-Sealant Color: [**As selected by Architect from manufacturer's full range**] <**Insert color**> <**Insert color designation of one of the joint-sealant products named in Part 2**>.

END OF SECTION 07920

# Division 8 - Doors and Windows

# SECTION 08111 - STANDARD STEEL DOORS AND FRAMES

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. This Section includes the following:

1. Standard hollow-metal steel doors.
2. Standard hollow-metal steel frames.

B. Related Sections include the following:

1. Division 4 Section "Unit Masonry Assemblies" for building anchors into and grouting standard steel frames in masonry construction.
2. Division 8 Section "Stainless-Steel Doors and Frames" for custom hollow-metal doors and frames manufactured from stainless steel.
3. Division 8 Section "Sound-Control Door Assemblies" for packaged, acoustical hollow-metal door and frame assemblies with STC ratings of 35 or more.
4. Division 8 Section "Glazing" for glazed lites in standard steel [**doors**] [**frames**] [**doors and frames**].
5. Division 8 Sections for door hardware for standard steel doors.
6. Division 9 painting Sections for field painting standard steel doors and frames.
7. Division 13 Section "Radiation Protection" for lead-lined, hollow-metal doors and frames.

### 1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings.

### 1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, core descriptions, label compliance, [**fire-resistance rating,** ] [**fire-resistance and temperature-rise ratings,** ]and finishes for each type of steel door and frame specified.

B. Shop Drawings: In addition to requirements below, provide a schedule of standard steel doors and frames using same reference numbers for details and openings as those on Drawings:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details.

3. Frame details for each frame type, including dimensioned profiles.
4. Details and locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, accessories, joints, and connections.
7. Details of glazing frames and stops showing glazing.
8. Details of conduit and preparations for electrified door hardware and controls.

C. Coordination Drawings: Drawings of each opening, including door and frame, drawn to scale and coordinating door hardware. Show elevations of each door design type, showing dimensions, locations of door hardware, and preparations for power, signal, and [**electrified**] [**and**] [**pneumatic**] control systems.

D. Samples for Initial Selection: For units with factory-applied color finishes.

E. Samples for Verification: For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (75 by 125 mm).

F. Oversize Construction Certification: For standard steel door assemblies required to be fire rated and exceeding limitations of labeled assemblies; include statement that doors comply with requirements of design, materials, and construction but have not been subjected to fire test.

G. Qualification Data: For [**Installer**] [**testing agency**].

H. Product Test Reports: Based on evaluation of comprehensive fire tests performed by a qualified testing agency, for each type of standard steel door and frame.

## 1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.

C. Source Limitations: Obtain standard steel doors and frames through one source from a single manufacturer.

D. Fire-Rated Door [**Sidelight**] [**and**] [**Transom**] Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated.

1. Test Pressure: Test at atmospheric (neutral) pressure according to NFPA 252 or UL 10B.
2. Test Pressure: Test according to [**NFPA 252 or UL 10C**] [**UBC Standard 7-2**]. After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches (1000 mm) or less above the sill.
3. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a testing agency acceptable to authorities having jurisdiction that doors comply with standard construction requirements for tested and labeled fire-protection-rated door assemblies except for size.
4. Temperature-Rise Rating: At exit enclosures, provide doors that have a temperature-rise rating of 450 deg F (250 deg C) maximum in 30 minutes of fire exposure.

E. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to [**NFPA 257 or UL 9**] [**UBC Standard 7-4**]. Label each individual glazed lite.

F. Smoke-Control Door Assemblies: Comply with [**NFPA 105 or UL 1784**] [**UBC Standard 7-2**].

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to finish of factory-finished doors and frames.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store doors and frames under cover at Project site. Place units in a vertical position with heads up, spaced by blocking, on minimum 4-inch- (102-mm-) high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber.

1. If wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

## 1.7 PROJECT CONDITIONS

A. Field Measurements: Verify openings by field measurements before fabrication and indicate measurements on Shop Drawings.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish opening dimensions and proceed with fabricating standard steel frames without field measurements. Coordinate wall construction to ensure that actual opening dimensions correspond to established dimensions.

## 1.8 COORDINATION

A. Coordinate installation of anchorages for standard steel frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in [**concrete**] [**or**] [**masonry**]. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amweld Building Products, LLC.
2. Benchmark Doors; a division of General Products Co., Inc.
3. Ceco Door Products; an ASSA ABLOY Group Company.
4. CURRIES Company; an ASSA ABLOY Group Company.
5. Deansteel Manufacturing, Inc.
6. Fleming Door Products Ltd.; an ASSA ABLOY Group Company.
7. Kewanee Corporation (The).
8. Mesker Door Inc.
9. Pioneer Industries, Inc.
10. Republic Builders Products Company.
11. Steelcraft; an Ingersoll-Rand Company.
12. <**Insert manufacturer's name.**>

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum A40 (ZF120) zinc-iron-alloy (galvannealed) coating designation.

D. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591/A 591M, Commercial Steel (CS), Class B coating; mill phosphatized.

E. Supports and Anchors: After fabricating, galvanize units to be built into exterior walls according to ASTM A 153/A 153M, Class B.

F. Inserts, Bolts, and Fasteners: Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153/A 153M.

G. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching standard steel door frames of type indicated.

H. Grout: Comply with Division 4 Section "Unit Masonry Assemblies."

I. Grout: Comply with ASTM C 476, with a slump of 4 inches (102 mm) for standard steel door frames built into concrete or masonry, as measured according to ASTM C 143/C 143M.

J. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. (96- to 192-kg/cu. m) density; with maximum flame-spread and smoke-developed indexes of 25 and 50 respectively; passing ASTM E 136 for combustion characteristics.

K. Glazing: Comply with requirements in Division 8 Section "Glazing."

L. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

## 2.3 STANDARD STEEL DOORS

A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces, unless otherwise indicated. Comply with ANSI A250.8.

1. Design: [**Flush panel**] [**Embossed panel**] [**As indicated on Drawings**].
2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, mineral-board, or vertical steel-stiffener core that produces doors complying with ANSI A250.8.

    a. Fire Door Core: As required to provide fire-protection[ **and temperature-rise**] ratings indicated.
    b. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than [**4.0 deg F x h x sq. ft./Btu (0.704 K x sq. m/W)**] [**6.0 deg F x h x sq. ft./Btu (1.057 K x sq. m/W)**] [**12.3 deg F x h x sq. ft./Btu (2.166 K x sq. m/W)**] <**Insert R-value**> when tested according to ASTM C 1363.

        1) Locations: [**Exterior doors**] [**and**] [**interior doors where indicated**].

3. Vertical Edges for Single-Acting Doors: [**Beveled edge**] [**Square edge**] [**Beveled edge unless square edge is indicated**] [**Square edge unless beveled edge is indicated**].

    a. Beveled Edge: 1/8 inch in 2 inches (3 mm in 50 mm).

4. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch (54-mm) radius.
5. Top and Bottom Edges: Closed with flush or inverted 0.042-inch- (1.0-mm-) thick end closures or channels of same material as face sheets.
6. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."

B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Level 1 and Physical Performance Level C, (Standard Duty), Model [**1 (Full Flush)**] [**2 (Seamless)**].
2. Level 2 and Physical Performance Level B (Heavy Duty), Model [**1 (Full Flush)**] [**2 (Seamless)**].
3. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model [**1 (Full Flush)**] [**2 (Seamless)**] [**3 (Stile and Rail)**].
4. Level 4 and Physical Performance Level A (Maximum Duty), Model [**1 (Full Flush)**] [**2 (Seamless)**].

C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet, unless otherwise indicated to comply with exterior door requirements. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:

1. Level 1 and Physical Performance Level C, (Standard Duty), Model [**1 (Full Flush)**] [**2 (Seamless)**].
2. Level 2 and Physical Performance Level B (Heavy Duty), Model [**1 (Full Flush)**] [**2 (Seamless)**].
3. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model [**1 (Full Flush)**] [**2 (Seamless)**] [**3 (Stile and Rail)**].
4. Level 4 and Physical Performance Level A (Maximum Duty), Model [**1 (Full Flush)**] [**2 (Seamless)**].

D. Hardware Reinforcement: Fabricate reinforcement plates from same material as door face sheets to comply with the following minimum sizes:

1. Hinges: Minimum 0.123 inch (3.0 mm) thick by 1-1/2 inches (38 mm) wide by 6 inches (152 mm) longer than hinge, secured by not less than 6 spot welds.
2. Pivots: Minimum 0.167 inch (4.2 mm) thick by 1-1/2 inches (38 mm) wide by 6 inches (152 mm) longer than hinge, secured by not less than 6 spot welds.
3. Lock Face[**, Flush Bolts,**] Closers, and Concealed Holders: Minimum 0.067 inch (1.7 mm) thick.
4. All Other Surface-Mounted Hardware: Minimum 0.067 inch (1.7 mm) thick.

E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

## 2.4 STANDARD STEEL FRAMES

A. General: Comply with ANSI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated from metallic-coated steel sheet.

1. Fabricate frames with mitered or coped and welded face corners[ **and seamless face joints**].
2. Frames for Level 1 Steel Doors: [**0.042-inch- (1.0-mm-)**] [**0.053-inch- (1.3-mm-)**] thick steel sheet[**, unless otherwise indicated**].
3. Frames for Level 2 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet[**, unless otherwise indicated**].

4. Frames for Level 3 Steel Doors: [**0.053-inch- (1.3-mm-)**] [**0.067-inch- (1.7-mm-)**] thick steel sheet[**, unless otherwise indicated**].
5. Frames for Level 4 Steel Doors: [**0.067-inch- (1.7-mm-)**] [**0.093-inch- (2.3-mm-)**] thick steel sheet[**, unless otherwise indicated**].

C. Interior Frames: Fabricated from cold-rolled steel sheet, unless otherwise indicated to comply with exterior frame requirements.

1. Fabricate frames with mitered or coped and welded face corners [**and seamless face joints**] [**, unless otherwise indicated**].
2. Fabricate knocked-down frames with mitered or coped corners, for field assembly[ **where indicated**].
3. Fabricate knocked-down, drywall slip-on frames for in-place gypsum board partitions.
4. Frames for Level 1 Steel Doors: [**0.042-inch- (1.0-mm-)**] [**0.053-inch- (1.3-mm-)**] thick steel sheet[**, unless otherwise indicated**].
5. Frames for Level 2 Steel Doors: 0.053-inch- (1.3-mm-) thick steel sheet[**, unless otherwise indicated**].
6. Frames for Level 3 Steel Doors: [**0.053-inch- (1.3-mm-)**] [**0.067-inch- (1.7-mm-)**] thick steel sheet[**, unless otherwise indicated**].
7. Frames for Wood Doors: [**0.042-inch- (1.0-mm-)**] [**0.053-inch- (1.3-mm-)**] [**0.067-inch- (1.7-mm-)**] [**0.093-inch- (2.3-mm-)**] thick steel sheet[**, unless otherwise indicated**].
8. Frames for Borrowed Lights: [**0.042-inch- (1.0-mm-)**] [**0.053-inch- (1.3-mm-)**] thick steel sheet[**, unless otherwise indicated**].

D. Hardware Reinforcement: Fabricate reinforcement plates from same material as frames to comply with the following minimum sizes:

1. Hinges: Minimum 0.123 inch (3.0 mm) thick by 1-1/2 inches (38 mm) wide by 6 inches (152 mm) longer than hinge, secured by not less than 6 spot welds.
2. Pivots: Minimum 0.167 inch (4.2 mm) thick by 1-1/2 inches (38 mm) wide by 6 inches (152 mm) longer than hinge, secured by not less than 6 spot welds.
3. Lock Face[**, Flush Bolts,**] Closers, and Concealed Holders: Minimum 0.067 inch (1.7 mm) thick.
4. All Other Surface-Mounted Hardware: Minimum 0.067 inch (1.7 mm) thick.

E. Supports and Anchors: Fabricated from electrolytic zinc-coated or metallic-coated steel sheet.

F. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (50 mm) wide by 10 inches (250 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.
2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.
3. Compression Type for Slip-on Frames: Adjustable compression anchors.
4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

G. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (50-mm) height adjustment. Terminate bottom of frames at finish floor surface.

H. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

I. Ceiling Struts: Minimum 3/8-inch-thick by 2-inch- (9.5-mm-thick by 50-mm-) wide steel.

J. Plaster Guards: Formed from same material as frames, not less than 0.016-inch (0.4-mm) thick.

## 2.5 STOPS AND MOLDINGS

A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as door face sheet in which they are installed.

B. Fixed Frame Moldings: Formed integral with standard steel frames, minimum 5/8 inch (16 mm) high, unless otherwise indicated.

C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch (0.8 mm) thick, fabricated from same material as frames in which they are installed.

D. Hospital Stops: Where indicated on interior door frames, terminate stops 6 inches (152 mm) above finish floor with a [**45**] [**90**]-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.

1. Provide terminated stops [**where indicated**] [**, unless otherwise indicated**].

## 2.6 FABRICATION

A. General: Fabricate standard steel doors and frames to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Standard Steel Doors:

1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
2. Glazed Lites: Factory cut openings in doors.

C. Standard Steel Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
2. [**Sidelight**] [**and**] [**Transom Bar**] Frames: Provide closed tubular members with no visible face seams or joints; fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners, unless otherwise indicated.
4. Plaster Guards: Weld guards to frame at back of hardware mortises in frames installed in concrete or masonry.
5. Where installed in masonry, leave vertical mullions in frames open at top for grouting.
6. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
7. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:

        1) Two anchors per jamb up to 60 inches (1524 mm) in height.
        2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) in height.
        3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) in height.
        4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof more than 120 inches (3048 mm) in height.

    b. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:

        1) Three anchors per jamb up to 60 inches (1524 mm) in height.
        2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) in height.
        3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) in height.
        4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches (610 mm) or fraction thereof more than 96 inches (2438 mm) in height.
        5) Two anchors per head for frames more than 42 inches (1066 mm) wide and mounted in metal-stud partitions.

    c. Compression Type: Not less than two anchors in each jamb.
    d. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.

8. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Provide plastic plugs to keep holes clear during construction.

    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

D. Hardware Preparation: Factory prepare standard steel doors and frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Division 8 Section "Door Hardware."

1. Reinforce doors and frames to receive nontemplated mortised and surface-mounted door hardware.
2. Comply with applicable requirements in ANSI A250.6 and ANSI/DHI A115 Series specifications for door and frame preparation for hardware. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI A250.8.

E. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of door or frame.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings such that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
4. Provide loose stops and moldings on inside of doors and frames.
5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

## 2.7 STEEL FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish standard steel door and frames after assembly.

B. Metallic-Coated Steel Surface Preparation: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

C. Steel Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning"; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel; comply with SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

D. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils (0.018 mm).

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.

E. Factory-Applied Paint Finish: Manufacturer's standard, complying with ANSI A250.3 for performance and acceptance criteria.

1. Color and Gloss: [**As indicated by manufacturer's designations**] [**Match Architect's sample**] [**As selected by Architect from manufacturer's full range**].

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of standard steel doors and frames.

1. Examine roughing-in for embedded and built-in anchors to verify actual locations of standard steel frame connections before frame installation.
2. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

A. Remove welded-in shipping spreaders installed at factory.

B. Prior to installation and with installation spreaders in place, adjust and securely brace standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:

1. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a perpendicular line from head to floor.

C. Drill and tap doors and frames to receive nontemplated mortised and surface-mounted door hardware.

### 3.3 INSTALLATION

A. General: Provide doors and frames of sizes, thicknesses, and designs indicated. Install standard steel doors and frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Standard Steel Frames: Install standard steel frames for [**doors**] [**sidelights**] [**transoms**] [**borrowed lights**] and other openings, of size and profile indicated. Comply with SDI 105.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

    a. At fire-protection-rated openings, install frames according to NFPA 80.
    b. Where frames are fabricated in sections due to shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    c. Install frames with removable glazing stops located on secure side of opening.
    d. Install door silencers in frames before grouting.
    e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    f. Check plumb, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    g. Apply bituminous coating to backs of frames that are filled with mortar, grout, and plaster containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor and secure with postinstalled expansion anchors.

    a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar as specified in Division 4 Section "Unit Masonry Assemblies."
5. Concrete Walls: Solidly fill space between frames and concrete with grout. Install grout in lifts and take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
7. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to supporting construction above, unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction above. Provide adjustable wedged or bolted anchorage to frame jamb members.
9. Installation Tolerances: Adjust standard steel door frames for squareness, alignment, twist, and plumb to the following tolerances:

    a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
    c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Standard Steel Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

a. Jambs and Head: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
b. Between Edges of Pairs of Doors: 1/8 inch (3 mm) plus or minus 1/16 inch (1.6 mm).
c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch (9.5 mm).
d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch (19 mm).

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors according to [**NFPA 105**] [**UBC Standard 7-2**].

D. Glazing: Comply with installation requirements in Division 8 Section "Glazing" and with standard steel door and frame manufacturer's written instructions.

1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c., and not more than 2 inches (50 mm) o.c. from each corner.

## 3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including standard steel doors or frames that are warped, bowed, or otherwise unacceptable.

B. Clean grout and other bonding material off standard steel doors and frames immediately after installation.

C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.

D. Galvannealed Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 08111

**SECTION 08710**
**FINISH HARDWARE**

## 1- RELATED DOCUMENTS

The general provisions of the Contract, including General and Special Conditions, apply to the work specified in this section.

## 2- DESCRIPTION OF WORK

The extent of finish hardware is shown on the drawings and in schedules. Finish hardware is hereby defined to include all items known commercially as builders hardware, as required for swing doors, except special types of hardware specified in the same section as the door and door frame.

## 3. QUALITY ASSURANCE

Manufacturer:

To the greatest extent possible, obtain each kind of hardware (latch and lock sets, hinges, closers, etc.) from only one manufacturer.

Supplier:

Subcontract the furnishing of hardware, only to a recognized builders hardware supplier who has been furnishing hardware for a period of not less than 2 years, and who has in his employment an experienced hardware consultant who is available at all reasonable times during the course of the work, for project hardware consultation to the A/E and Contractor.

Installer:

Assign the installation of hardware to experienced tradesmen either at the door and frame fabrication plant or at the project site at Contractor's option except as otherwise indicated.

Scheduled Designations:

Except as otherwise indicated, the use of one manufacturer's numeric designations system in schedules does not imply that another manufacturer's products will not be acceptable, unless they are not equal in design, size, weight, finish, function, or other quality of significance. However, do not make substitutions after A/E acceptance of final hardware schedule.

## 4. SUBMITTALS

Manufacturer's Data:

Submit 2 copies of manufacturer's data for each item of finish hardware for approval of A/E. Include whatever information may be necessary to show compliance with requirements, and include instructions for installation and for maintenance of operating parts and exposed finishes.

Hardware Schedule:

Submit 5 copies of the final hardware schedule after preliminary schedule is approved in writing by the A/E. Include a separate key schedule, showing clearly how the A/E final instructions on keying of locks have been fulfilled. Review and acceptance by the A/E does not relieve the Contractor of his exclusive responsibility to fulfill the requirements as shown and specified.

Samples:

Prior to submittal of the final hardware schedule submit for approval of A/E, one sample of each exposed hardware unit, finished as required, and tagged with full description for coordination with the schedule. No hardware shall be ordered, nor shall any work dependent upon approval proceed, until written approval of A/E has been obtained.

Samples will be returned to the Contractor. Units which are acceptable and remain undamaged through submittal, review and field comparison procedures may, after final check of operation, be installed by the Contractor where designated by the A/E. Furnish a record of such installation to the

## 5. JOB CONDITIONS

Coordination:

Coordinate hardware with other work. Tag each item or package separately, with identification related to the final hardware schedule, and include basic installation instructions in the package. Furnish hardware items of proper design for use on doors and frames of the thicknesses, profile, swing, security and similar requirements indicated, as necessary for proper installation and function, regardless of omissions or conflicts in the information in the contract documents. Deliver individually packaged hardware items at the times and to the locations (shop or field) for installation, as directed by the Contractors.

Templates:

Furnish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of hardware. Upon request, check the shop drawings of such other work, to confirm that adequate provisions will be made for the proper installation of hardware.

## 6. HARDWARE MATERIALS AND FABRICATION

Fasteners:

Manufacture hardware to conform to published templates, generally prepared for machine screw installation. Do not provide hardware which has been prepared for self-tapping sheet metal screws, except as specifically indicated.

Furnish screws for installation, with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed screws to match the hardware finish or, if exposed in surfaces of other work, to match the finish of such other work as closely as possible, except as otherwise indicated.

Provide concealed fasteners for hardware units which are exposed when the door is closed, except to the extent to no standard-manufactured units of the type specified are available with concealed fasteners.

Provide fasteners which are compatible with both the unit fastened and the substrate, and which will not cause corrosion or deterioration of hardware, base material or fastener.

## 7. HARDWARE FINISHES

All hardware will be US 26D, dull chromium plated, except as otherwise noted. Items not available in US 26D shall be supplied in sprayed aluminum finish.

Match the finish of every hardware unit at each door or opening, to the greatest extent possible, and except as otherwise indicated.

The A/E will be the sole judge of whether hardware units match the accepted samples and match each other satisfactorily.

Provide protective lacquer coating on all exposed hardware finishes of brass, bronze and aluminum, except as otherwise indicated.

## 8. HARDWARE MOUNTING HEIGHTS

Mount hardware units at heights recommended in "Recommended Locations for Builder's Hardware" by NBHA, except as otherwise specifically indicated or required to comply with governing regulations, and except as may be otherwise directed by the

## 9. INSTALLATION

Install each hardware item in compliance with the manufacturer's instructions and recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be painted or finished in another way, install each item completely and then remove and store in a secure place during the finish application. After completion of the finishes, re-install each item. Do not install surface-mounted items until finishes have been completed on the substrate.

## 10. ADJUST AND CLEAN

Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Lubricate moving parts with type lubrication recommended by manufacturer (graphite-type if no other recommended). Replace units which cannot be adjusted and lubricated to operate freely and smoothly as intended for the application made.

Final Adjustment:

Wherever hardware installations is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make a final check and adjustment of all hardware items in such space or area. Clean and re-lubricate operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of ventilating equipment.

Instruct Owner's personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.

## 11. KEYING SYSTEM

Provide a master keying system. In addition to the permanent system, a construction master keying system shall be incorporated for interim use during construction. Any pertinent keying requirements not specified herein shall be as directed.

Locks and padlocks shall be keyed differently unless otherwise required, and master-keyed (MK) as directed. Three keys shall be provided with each lock or cylinder. Each key shall be stamped with incised figures showing the key change number corresponding with the respective lock or cylinder, and in addition, space shall be provided on each key for the stamping of a code number as prescribed for the keying system.

Keys shall have aluminum numbered tags, one for each key, 1-1/16 inches in diameter, attached to key with aluminum chain link or beads. The scheme for numbering keys shall be furnished by the manufacturer.

**END OF SECTION**

# SECTION 08712 - DOOR HARDWARE (SCHEDULED BY DESCRIBING PRODUCTS)

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. This Section includes the following:

1. Commercial door hardware for the following:

    a. Swinging doors.
    b. Non-fire-rated sliding doors.
    c. Non-fire-rated folding doors.
    d. Other doors to the extent indicated.

2. Cylinders for doors specified in other Sections.
3. Electrified door hardware.

B. Related Sections include the following:

1. Division 8 Section "Standard Steel Doors and Frames" [**for astragals provided as part of fire-rated labeled assemblies**] [**and**] [**for door silencers provided as part of hollow-metal frames**].
2. Division 8 Section "Custom Steel Doors and Frames" [**for astragals provided as part of fire-rated labeled assemblies**] [**and**] [**for door silencers provided as part of hollow-metal frames**].
3. Division 8 Section "Interior Aluminum Frames" for door silencers provided as part of frames.
4. Division 8 Section "Stainless-Steel Doors and Frames" [**for astragals provided as part of fire-rated labeled assemblies**] [**and**] [**for door silencers provided as part of hollow-metal frames**].
5. Division 8 Section "Flush Wood Doors" for [**astragals**] [**and**] [**integral intumescent seals**] provided as part of fire-rated labeled assemblies.
6. Division 8 Section "Stile and Rail Wood Doors" for [**astragals**] [**and**] [**integral intumescent seals**] provided as part of fire-rated labeled assemblies.
7. Division 8 Section "Access Doors and Frames" for access door hardware, [**except**] [**including**] cylinders.
8. Division 8 Section "Steel Detention Doors and Frames" for door silencers provided as part of hollow-metal detention frames.
9. Division 8 Section "Overhead Coiling Doors" for door hardware provided as part of overhead door assemblies.

10. Division 8 Section "Overhead Coiling Grilles" for door hardware provided as part of overhead grille assemblies.
11. Division 8 Section "ICU/CCU Entrance Doors" for entrance door hardware, [**except**] [**including**] cylinders.
12. Division 8 Section "Sound-Control Door Assemblies" for hinges and gasketing provided as part of sound-rated door assemblies.
13. Division 8 Section "Aluminum-Framed Entrances and Storefronts" for entrance door hardware, [**except**] [**including**] cylinders.
14. Division 8 Section "All-Glass Entrances and Storefronts" for entrance door hardware, [**except**] [**including**] cylinders.
15. Division 8 Section "Sliding Automatic Entrance Doors" for entrance door hardware, [**except**] [**including**] cylinders.
16. Division 8 Section "Swinging Automatic Entrance Doors" for entrance door hardware, [**except**] [**including**] cylinders.
17. Division 8 Section "Folding Automatic Entrance Doors" for entrance door hardware, [**except**] [**including**] cylinders.
18. Division 8 Section "Detention Door Hardware" for hardware for detention doors.
19. Division 10 Section "Impact-Resistant Wall Protection" for plastic door protection units that match wall protection units.
20. Division 10 Section "Wire Mesh Partitions" for door hardware for doors in wire mesh partitions, [**except**] [**including**] cylinders.
21. Division 13 Section "Radiation Protection" for lead-lined astragals provided as part of fire-rated labeled assemblies.
22. Division 13 Section "Metal Building Systems" for door hardware, [**except**] [**including**] cylinders.
23. Division 13 Section "Intrusion Detection" for detection devices installed at door openings and provided as part of an intrusion detection system.
24. Division 13 Section "Security Access" for access control devices installed at door openings and provided as part of a security access system.
25. Division 13 Section "Fire Alarm" for connections to building fire alarm system.
26. Division 16 Sections for connections to electrical power system and for low-voltage wiring work.

C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.

1. [**Pivots**] [**thresholds**] [**weather stripping**] [**and**] [**cylinders for locks**] specified in other Sections.
2. Permanent cores to be installed by Owner.

## 1.3 DOOR HARDWARE ALLOWANCE

A. Door Hardware Selection: Furnish door hardware selected by Architect, in quantities specified in this Section and in Division 1 Section "Allowances."

B. Allowance Bidding: After Architect selects door hardware and issues the door hardware sets, request bids for products and materials.

C. Allowance Award: Architect will select bid from bids furnished by Contractor. Award purchase order to bidder selected.

D. Allowance Adjustment: A Change Order will be issued to adjust difference between door hardware allowance and selected bid from door hardware Installer.

E. Installation: General types and approximate quantities of door hardware are indicated in the list of door hardware sets to provide a basis for the cost of installation and other Work that is part of the Contract Sum but not included in door hardware allowance.

1.4 SUBMITTALS

A. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Details of electrified door hardware, indicating the following:

1. Wiring Diagrams: Power, signal, and control wiring. Include the following:

a. System schematic.
b. Point-to-point wiring diagram.
c. Riser diagram.
d. Elevation of each door.

2. Detail interface between electrified door hardware and [**fire alarm**] [**access control**] [**security**] [**building control**] system.
3. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.

C. Samples for Initial Selection: For each finish, color, and texture required for each type of door hardware indicated.

D. Samples for Verification: Submit minimum 2-by-4-inch (51-by-102-mm) plate Samples of each type of finish required, except primed finish.

E. Samples for Verification: For exposed door hardware of each type, in specified finish, full size. Tag with full description for coordination with the door hardware sets. Submit Samples before, or concurrent with, submission of the final door hardware sets.

1. Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

F. Product Certificates: For electrified door hardware, signed by product manufacturer.

1. Certify that door hardware approved for use on types and sizes of labeled fire doors complies with listed fire door assemblies.

G. Qualification Data: For [**Installer**] [**Architectural Hardware Consultant**].

H. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for [**locks**] [**latches**] [**delayed-egress locks**] [**and**] [**closers**].

I. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final [**hardware**] [**and**] [**keying**] schedule.

J. Warranty: Special warranty specified in this Section.

K. Other Action Submittals:

1. Door Hardware Sets: Prepared by or under the supervision of [**Installer**] [**Architectural Hardware Consultant**], detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

a. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
b. Format: Use same scheduling sequence and format[ **and use same door numbers**] as in the Contract Documents.
c. Content: Include the following information:

1) Identification number, location, hand, fire rating, and material of each door and frame.
2) Type, style, function, size, quantity, and finish of each door hardware item.[ **Include description and function of each lockset and exit device.**]
3) Complete designations of every item required for each door or opening including name and manufacturer.
4) Fastenings and other pertinent information.
5) Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
6) Explanation of abbreviations, symbols, and codes contained in schedule.
7) Mounting locations for door hardware.
8) Door and frame sizes and materials.
9) Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.

a) Sequence of Operation: Include description of component functions that occur in the following situations: authorized person wants to enter; authorized person wants to exit; unauthorized person wants to enter; unauthorized person wants to exit.

10) List of related door devices specified in other Sections for each door and frame.

d. Submittal Sequence: Submit the final door hardware sets at earliest possible date, particularly where approval of the door hardware sets must precede fabrication of other work that is critical in Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the door hardware sets.
e. Submittal Sequence: Submit initial draft of final schedule along with essential Product Data to facilitate the fabrication of other work that is critical in Project construction schedule. Submit the final door hardware sets after Samples, Product

Data, coordination with Shop Drawings of other work, delivery schedules, and similar information has been completed and accepted.

2. Keying Schedule: Prepared by or under the supervision of [**Installer**] [**Architectural Hardware Consultant**], detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

## 1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by lock manufacturer.

1. Installer's responsibilities include supplying and installing door hardware, and providing a qualified Architectural Hardware Consultant available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
2. Installer shall have warehousing facilities in Project's vicinity.
3. Scheduling Responsibility: Preparation of door hardware and keying schedules.
4. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

B. Architectural Hardware Consultant Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

1. Electrified Door Hardware Consultant Qualifications: A qualified Architectural Hardware Consultant who is experienced in providing consulting services for electrified door hardware installations.

C. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

D. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to [**NFPA 252**] [**UBC Standard 7-2**].

1. Test Pressure: [**Test at atmospheric pressure**] [**After 5 minutes into the test, neutral pressure level in furnace shall be established at 40 inches (1016 mm) or less above the sill**].

E. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

F. Keying Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." In addition to

Owner[**, Construction Manager,**] Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant[ **and Owner's security consultant**]. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:

1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
2. Preliminary key system schematic diagram.
3. Requirements for key control system.
4. Address for delivery of keys.
5. <**Insert requirements to suit Project.**>

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to electrified door hardware including, but not limited to, the following:

1. Inspect and discuss electrical roughing-in and other preparatory work performed by other trades.
2. Review sequence of operation for each type of electrified door hardware.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review required testing, inspecting, and certifying procedures.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

D. Deliver keys[ **and permanent cores**] to Owner by registered mail or overnight package service.

1. <**Insert name and address of Owner's representative.**>

## 1.7 COORDINATION

A. Coordinate layout and installation of recessed [**pivots**] [**and**] [**closers**] with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 3.

B. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to

confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

C. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to [**power supplies**] [**fire alarm system and detection devices**] [**access control system**] [**security system**] [**building control system**].

D. Existing Openings: Where new hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide for proper operation.

## 1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection, cracking, or breakage.
b. Faulty operation of operators and door hardware.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: [**Three**] <**Insert number**> years from date of Substantial Completion, except as follows:

a. [**Electromagnetic**] [**Delayed-Egress**] Locks: [**Five**] <**Insert number**> years from date of Substantial Completion.
b. Exit Devices: [**Two**] <**Insert number**> years from date of Substantial Completion.
c. Manual Closers: [**10**] <**Insert number**> years from date of Substantial Completion.
d. Concealed Floor Closers: [**Five**] [**10**] [**25**] <**Insert number**> years from date of Substantial Completion.

## 1.9 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, provide [**six**] <**Insert number**> months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door hardware operation. Provide parts and supplies same as those used in the manufacture and installation of original products.

1.10 EXTRA MATERIALS

A. Furnish full-size units of door hardware described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Door Hardware: <**Insert detailed descriptions and specific numbers of units.**>
2. Electrical Parts: <**Insert detailed descriptions and specific numbers of units.**>

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section[ **and door hardware sets indicated in door and frame schedule**] [ **and door hardware sets indicated in Part 3 "Door Hardware Sets" Article**].

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated.
2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Sets" Article. Products are identified by descriptive titles corresponding to requirements specified in Part 2.

C. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 HINGES, GENERAL

A. Quantity: Provide the following, unless otherwise indicated:

1. Two Hinges: For doors with heights up to 60 inches (1524 mm).
2. Three Hinges: For doors with heights 61 to 90 inches (1549 to 2286 mm).
3. Four Hinges: For doors with heights 91 to 120 inches (2311 to 3048 mm).
4. For doors with heights more than 120 inches (3048 mm), provide 4 hinges, plus 1 hinge for every 30 inches (750 mm) of door height greater than 120 inches (3048 mm).

B. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

C. Hinge Weight: Unless otherwise indicated, provide the following:

1. Entrance Doors: Heavy-weight hinges.
2. Doors with Closers: Antifriction-bearing hinges.
3. Interior Doors: Standard-weight hinges.

D. Hinge Base Metal: Unless otherwise indicated, provide the following:

1. Exterior Hinges: [**Stainless steel, with stainless-steel pin**] [**Brass, with stainless-steel pin body and brass protruding heads**].
2. Interior Hinges: [**Brass, with stainless-steel pin body and brass protruding heads**] [**Steel, with steel pin**] [**Stainless steel, with stainless-steel pin**].
3. Hinges for Fire-Rated Assemblies: [**Steel, with steel pin**] [**Stainless steel, with stainless-steel pin**].

E. Hinge Options: Where indicated in door hardware sets or on Drawings:

1. Hospital Tips: Slope ends of hinge barrel.
2. Decorator Tips: [**Oval**] [**Ball**] [**Steeple**] [**Urn**] [**Acorn**].
3. Safety Stud: Designed for stud in one leaf to engage hole in opposing leaf.
4. Maximum Security Pin: Fix pin in hinge barrel after it is inserted.
5. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for [**outswinging exterior doors**] [**and**] [**outswinging corridor doors with locks**].
6. Corners: [**Square**] [**5/32-inch (4-mm) radius**] [**1/4-inch (6-mm) radius**] [**5/8-inch (16-mm) radius**].

F. Electrified Functions for Hinges: Comply with the following:

1. Power Transfer: Concealed PTFE-jacketed wires, secured at each leaf and continuous through hinge knuckle.
2. Monitoring: Concealed electrical monitoring switch.
3. Power Transfer and Monitoring: Concealed PTFE-jacketed wires, secured at each leaf and continuous through hinge knuckle, and with concealed electrical monitoring switch.

G. Fasteners: Comply with the following:

1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
2. Wood Screws: For wood doors and frames.
3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
4. Screws: Phillips flat-head; [**machine screws (drilled and tapped holes) for metal doors**] [**wood screws for wood doors and frames**]. Finish screw heads to match surface of hinges.

## 2.3 HINGES

A. Butts and Hinges: Listed under Category A in BHMA's "Certified Product Directory."

B. Template Hinge Dimensions: BHMA A156.7.

C. [**Available** ]Manufacturers:

1. Baldwin Hardware Corporation.
2. Bommer Industries, Inc.
3. Cal-Royal Products, Inc.
4. Hager Companies.
5. Lawrence Brothers, Inc.
6. McKinney Products Company; an ASSA ABLOY Group company.
7. PBB, Inc.
8. Stanley Commercial Hardware; Div. of The Stanley Works.
9. <**Insert manufacturer's name.**>

D. Antifriction-Bearing, Full-Mortise (Butt) Hinges: BHMA A156.1, [**heavy weight; Grade 1, with 4 ball bearings**] [**standard weight; Grade 2, with 2 ball bearings**]; button tips; nonrising removable pins; and base metal as follows:

1. Base Metal: [**Cast, forged, or extruded brass or bronze**] [**Wrought brass or bronze**] [**Stainless steel**] [**Wrought, forged, or cast steel, or malleable iron**].

E. Antifriction-Bearing, Swing-Clear, Full-Mortise (Butt) Hinges: BHMA A156.1, [**heavy weight; Grade 1, with 4 ball bearings**] [**standard weight; Grade 2, with 2 ball bearings**]; button tips; nonrising removable pins; reversible; with 3/32-inch (2.4-mm) swaging; wrought, forged, or cast steel, or malleable iron.

F. Plain-Bearing, Standard-Weight, Full-Mortise (Butt) Hinges: BHMA A156.1, Grade 3, button tips, nonrising removable pins, and base metal as follows:

1. Base Metal: [**Cast, forged, or extruded brass or bronze**] [**Wrought brass or bronze**] [**Stainless steel**] [**Wrought, forged, or cast steel, or malleable iron**].

G. Plain-Bearing, Swing-Clear, Standard-Weight, Full-Mortise (Butt) Hinges: BHMA A156.1, Grade 3, button tips, nonrising removable pins, reversible; wrought, forged, or cast steel, or malleable iron.

H. Friction-Type, Heavy-Weight, Full-Mortise (Butt) Hinges: BHMA A156.1, Grade 1, with adjustable friction discs or bearings; wrought, forged, or cast steel, or malleable iron.

I. Antifriction-Bearing, Heavy-Weight, Full-Mortise, Slip-in-Type Hinges: BHMA A156.1, Grade 1, equipped with 4 ball bearings, with [**5/16-inch (7.9-mm) swaging**] [**3/16-inch (4.8-mm) swaging, handed,**] and base metal as follows:

1. Base Metal: [**Wrought brass or bronze**] [**Wrought, forged, or cast steel, or malleable iron**].

J. Antifriction-Bearing, Standard-Weight, Full-Mortise, Slip-in-Type Hinges: BHMA A156.1, Grade 2, equipped with 2 ball bearings, with [**5/16-inch (7.9-mm) swaging**] [**3/16-inch (4.8-mm) swaging, handed,**] and base metal as follows:

1. Base Metal: [**Wrought brass or bronze**] [**Wrought, forged, or cast steel, or malleable iron**].

K. Plain-Bearing, Standard-Weight, Full-Mortise, Slip-in-Type Hinges: BHMA A156.1, Grade 3, with [**5/16-inch (7.9-mm) swaging**] [**3/16-inch (4.8-mm) swaging, handed,**] and base metal as follows:

1. Base Metal: [**Wrought brass or bronze**] [**Wrought, forged, or cast steel, or malleable iron**].

L. Antifriction-Bearing, Half-Mortise Hinges: BHMA A156.1, [**heavy weight; Grade 1, with 4 ball bearings**] [**standard weight; Grade 2, with 2 ball bearings**]; button tips; nonrising removable pins; reversible; and base metal as follows:

1. Base Metal: [**Wrought brass or bronze**] [**Stainless steel**] [**Wrought, forged, or cast steel, or malleable iron**].

M. Antifriction-Bearing, Swing-Clear, Heavy-Weight, Half-Mortise Hinges: BHMA A156.1, Grade 1, button tips, nonrising removable pins, reversible, equipped with 4 ball bearings; wrought, forged, or cast steel, or malleable iron.

N. Plain-Bearing, Standard-Weight, Half-Mortise Hinges: BHMA A156.1, Grade 3, button tips, nonrising removable pins, reversible, and base metal as follows:

1. Base Metal: [**Wrought brass or bronze**] [**Stainless steel**] [**Wrought, forged, or cast steel, or malleable iron**].

O. Antifriction-Bearing, Full-Surface Hinges: BHMA A156.1, [**heavy weight; Grade 1, with 4 ball bearings**] [**narrow, heavy weight; Grade 1, with 4 ball bearings**] [**standard weight; Grade 2, with 2 ball bearings**]; button tips; nonrising removable pins; reversible; and base metal as follows:

1. Base Metal: [**Wrought brass or bronze**] [**Stainless steel**] [**Wrought, forged, or cast steel, or malleable iron**].

P. Antifriction-Bearing, Swing-Clear, Heavy-Weight, Full-Surface Hinges: BHMA A156.1, Grade 1, button tips, nonrising removable pins, reversible, equipped with 4 ball bearings; wrought, forged, or cast steel, or malleable iron.

Q. Plain-Bearing, Standard-Weight, Full-Surface Hinges: BHMA A156.1, Grade 3, button tips, nonrising removable pins, and base metal as follows:

1. Base Metal: [**Wrought brass or bronze**] [**Wrought, forged, or cast steel, or malleable iron**].

R. Antifriction-Bearing, Half-Surface Hinges: BHMA A156.1, [**heavy weight; Grade 1, with 4 ball bearings**] [**standard weight; Grade 2, with 2 ball bearings**]; button tips; nonrising removable pins; reversible; and base metal as follows:

1. Base Metal: [**Wrought brass or bronze**] [**Stainless steel**] [**Wrought, forged, or cast steel, or malleable iron**].

S. Antifriction-Bearing, Swing-Clear, Heavy-Weight, Half-Surface Hinges: BHMA A156.1, Grade 1, button tips, nonrising removable pins, reversible, equipped with 4 ball bearings; wrought, forged, or cast steel, or malleable iron.

T. Plain-Bearing, Standard-Weight, Half-Surface Hinges: BHMA A156.1, Grade 3, button tips, nonrising removable pins, reversible, and base metal as follows:

1. Base Metal: [**Wrought brass or bronze**] [**Wrought, forged, or cast steel, or malleable iron**].

U. Pivot-Reinforced Hinge and Hinge Sets: BHMA A156.1, Grade 1; consisting of one pivot-reinforced hinge plus two full-mortise hinges; heavy weight, antifriction bearing, handed; nonremovable pins; and base metal as follows:

1. Base Metal: [**Wrought brass or bronze**] [**Stainless steel**] [**Wrought, forged, or cast steel, or malleable iron**].

V. Anchor Hinge and Hinge Sets: BHMA A156.1, Grade 1; consisting of one anchor hinge plus two full-mortise hinges; heavy weight, antifriction bearing, handed; nonremovable pins; and base metal as follows:

1. Base Metal: [**Wrought brass or bronze**] [**Stainless steel**] [**Wrought, forged, or cast steel, or malleable iron**].

W. Thrust-Pivot Unit and Hinge Sets: BHMA A156.1, Grade 1; consisting of one thrust-pivot unit plus three full-mortise hinges; heavy weight, antifriction bearing, handed; nonremovable pins; and base metal as follows:

1. Base Metal: [**Wrought brass or bronze**] [**Stainless steel**] [**Wrought, forged, or cast steel, or malleable iron**].

X. Olive-Knuckle Hinges: BHMA A156.1, antifriction bearing, full mortise, [**heavy weight; Grade 1**] [**standard weight; Grade 2**], equipped with bearing unit, handed; only knuckle visible when door is closed; and base metal as follows:

1. Base Metal: [**Cast, forged, or extruded brass or bronze**] [**Wrought, forged, or cast steel, or malleable iron**].

Y. Antifriction-Bearing, Heavy-Weight, Pivot Hinges: BHMA A156.1, Grade 1, full mortise, equipped with concealed bearing unit, handed; only knuckle visible when door is closed; and base metal as follows:

1. Base Metal: [**Cast, forged, or extruded brass or bronze**] [**Wrought steel**].

Z. Antifriction-Bearing, Standard-Weight, Pivot Hinges: BHMA A156.1, Grade 2, full mortise, equipped with concealed bearing unit, handed; only knuckle visible when door is closed; wrought steel.

AA. Pocket Hinges: Heavy weight; antifriction bearing; BHMA A156.1, Grade 1; jamb leaf visible when door is closed and both leaves concealed when door is in pocket; type and size required for application indicated; and base metal as follows:

1. Base Metal: [**Cast, forged, or extruded brass or bronze**] [**Stainless steel**] [**Wrought, forged, or cast steel, or malleable iron**].

## 2.4 SPRING HINGES

A. Self-Closing Hinges: Listed under Category A in BHMA's "Certified Product Directory."

B. [**Available** ]Manufacturers:

1. Baldwin Hardware Corporation.
2. Bommer Industries, Inc.
3. Cal-Royal Products, Inc.
4. Hager Companies.
5. Lawrence Brothers, Inc.
6. McKinney Products Company; an ASSA ABLOY Group company.
7. PBB, Inc.
8. Stanley Commercial Hardware; Div. of The Stanley Works.
9. <**Insert manufacturer's name.**>

C. Single-Acting, Full-Mortise, Spring Hinges: BHMA A156.17[**, Grade 1**] [**, Grade 2**], wrought steel, with torsion spring[**; listed for use on fire doors**].

D. Single-Acting, Full-Surface, Spring Hinges: BHMA A156.17[**, Grade 1**] [**, Grade 2**], wrought steel, with torsion spring.

E. Single-Acting, Half-Surface, Spring Hinges: BHMA A156.17[**, Grade 1**] [**, Grade 2**], wrought steel, with torsion spring[**; listed for use on fire doors**].

F. Double-Acting, Mortised-in-Door, Spring Hinges: BHMA A156.17[**, Grade 1**] [**, Grade 2**], surface applied to jamb; adjustable tension, torsion springs; wrought steel.

G. Double-Acting, Half-Surface, Spring Hinges: BHMA A156.17[**, Grade 1**] [**, Grade 2**], adjustable tension, torsion springs; wrought steel.

## 2.5 PIVOTS AND PIVOT HINGES

A. Pivots: Listed under Category C in BHMA's "Certified Product Directory."

B. Self-Closing Pivots: Listed under Category A in BHMA's "Certified Product Directory."

C. [**Available** ]Manufacturers:

1. Bommer Industries, Inc.
2. DORMA Architectural Hardware; Member of The DORMA Group North America.
3. Glynn-Johnson; an Ingersoll-Rand Company.
4. Hager Companies.
5. IVES Hardware; an Ingersoll-Rand Company.
6. McKinney Products Company; an ASSA ABLOY Group company.
7. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
8. Stanley Commercial Hardware; Div. of The Stanley Works.

9. <**Insert manufacturer's name.**>

D. Double-Acting Door Pivots: BHMA A156.4, Grade 2, consisting of one top and one bottom assembly with bearings; nonferrous bottom jamb bracket; wrought brass or bronze.

E. Double-Acting, Door Pivots: BHMA A156.4, Grade 2, stainless-steel or polycarbonate top and bottom, each a walking-type, cam-operated pivot; [**surface**] [**flush**] mounted.

F. Single-Acting, Center-Hung, Door Pivots: BHMA A156.4, Grade [**2**] [**3**], wrought-brass or bronze top and bottom units, each containing rack-and-pinion assemblies permitting door to open 105 degrees; reversible.

G. Center Pivot Sets: BHMA A156.4, Grade 1, type and size required for application indicated; complying with the following:

1. Top Pivots: Walking-beam type with retractable pin and oil-impregnated bronze bearing; mortised into door and frame.
2. Bottom Pivots: [**Surface floor mounted,**] [**Recessed in floor in cement case,**] [**Mortised into jamb,**] and mortised into door; with [**thrust ball**] [**needle**] bearing.
3. Base Metal: [**Brass**] [**Bronze**] [**Steel**].

H. Offset Pivot Sets: BHMA A156.4, Grade [**1**] [**2**], type and size required for application indicated; complying with the following:

1. Offset: [**3/4 inch (19 mm)**] [**1-1/2 inches (38 mm)**].
2. Fire Rated: Listed for use with labeled fire doors where indicated.
3. Top Pivots: Walking-beam type with retractable pin and oil-impregnated bronze bearing; mortised into door and frame[**; with asylum-type upper surface**].
4. Bottom Pivots: [**Surface floor mounted,**] [**Recessed in floor in cement case,**] [**Mortised into jamb,**] and mortised into door; with [**thrust ball**] [**needle**] bearing.
5. Base Metal: [**Brass**] [**Bronze**] [**Stainless steel**] [**Steel**].

I. Intermediate Pivot Sets: BHMA A156.4, Grade 1, type and size required for application indicated; with oil-impregnated bronze bearing; complying with the following:

1. Offset: [**3/4 inch (19 mm)**] [**1-1/2 inches (38 mm)**].
2. Mounting: [**Full mortise**] [**Half mortise**] [**Half surface**] [**Full surface**].
3. Knuckle: [**Standard**] [**Asylum type**].
4. Fire Rated: Listed for use with labeled fire doors where indicated.
5. Base Metal: [**Brass**] [**Bronze**] [**Stainless steel**] [**Steel**].
6. Electrified Functions: As follows:

a. Power Transfer: Concealed PTFE-jacketed wires, secured at each leaf and continuous through hinge knuckle.
b. Monitoring: Concealed electrical monitoring switch.

J. Double-Acting, Gate-Spring Pivot: BHMA A156.17, Grade 1, mortise application, [**adjustable**] [**fixed**] tension, and base metal as follows:

1. Base Metal: [**Cast, forged, or extruded brass or bronze**] [**Malleable iron**].

K. Double-Acting, Gravity Pivot: BHMA A156.17, Grade 1, malleable iron, surface applied, [**adjustable**] [**fixed**] tension.

## 2.6 CONTINUOUS HINGES

A. Standard: BHMA A156.26[**, Grade 1-150**] [**, Grade 1-300**] [**, Grade 1-600**] [**, Grade 2-150**] [**, Grade 2-300**] [**, Grade 2-600**] [**, Grade 3-150**] [**, Grade 3-300**].

1. Continuous Hinges: Listed under Category N in BHMA's "Certified Product Directory."

B. General: Minimum 0.120-inch- (3.0-mm-) thick, hinge leaves with minimum overall width of 4 inches (102 mm); fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.

1. Fire Pins: Steel pins to hold labeled fire doors in place if required by tested listing.

C. Continuous, Barrel-Type Hinges: Hinge with knuckles formed around a pin that extends entire length of hinge.

1. Base Metal for Exterior Hinges: Stainless steel.
2. Base Metal for Interior Hinges: [**Stainless steel**] [**Steel**] [**Aluminum**].
3. Base Metal for Hinges for Fire-Rated Assemblies: [**Stainless steel**] [**Steel**].
4. [**Available** ]Manufacturers:

    a. Hager Companies.
    b. Markar Architectural Products, Inc.; a Subsidiary of Adams Rite Manufacturing Co.
    c. McKinney Products Company; an ASSA ABLOY Group company.
    d. Stanley Commercial Hardware; Div. of The Stanley Works.
    e. Zero International.
    f. <**Insert manufacturer's name.**>

D. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves; joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.

1. Type: [**Fully concealed**] [**Swing clear**] [**Full surface, with removable continuous caps over fasteners**] [**Half surface, with removable continuous cap over fasteners**].
2. [**Available** ]Manufacturers:

    a. Bommer Industries, Inc.
    b. Hager Companies.
    c. McKinney Products Company; an ASSA ABLOY Group company.
    d. Pemko Manufacturing Co.
    e. Select Products Limited.
    f. Zero International.
    g. <**Insert manufacturer's name.**>

2.7 LOCKS AND LATCHES, GENERAL

A. Accessibility Requirements: Where indicated to comply with accessibility requirements, comply with [**the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."**] [**ANSI A117.1.**] [**FED-STD-795, "Uniform Federal Accessibility Standards."**] <**Insert local regulation.**>

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22 N).

B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf (67 N) to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.

C. Electrified Locking Devices: BHMA A156.25.

D. Lock Trim:

1. Levers: [**Wrought**] [**Forged**] [**Cast**].

a. <**Insert model number and description.**>

2. Knobs: [**Wrought**] [**Forged**] [**Cast**].
3. Escutcheons (Roses): [**Wrought**] [**Forged**] [**Cast**].
4. Dummy Trim: Match [**knob**] [**lever**] lock trim and escutcheons.
5. Lockset Designs: [**Provide design indicated on Drawings**] <**Insert name(s) of manufacturer(s) and product name(s) designating lockset design(s) that other manufacturers must match**> or, if sets are provided by another manufacturer, provide designs that match those designated.

E. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Bored Locks: Minimum 1/2-inch (13-mm) latchbolt throw.
2. Mortise Locks: Minimum 3/4-inch (19-mm) latchbolt throw.
3. Deadbolts: Minimum 1-inch (25-mm) bolt throw.

F. Rabbeted Meeting Doors: Provide special rabbeted front and strike on locksets for rabbeted meeting stiles.

G. Backset: 2-3/4 inches (70 mm), unless otherwise indicated.

H. Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, and as follows:

1. Strikes for Bored Locks and Latches: BHMA A156.2.
2. Strikes for Mortise Locks and Latches: BHMA A156.13.
3. Strikes for Interconnected Locks and Latches: BHMA A156.12.
4. Strikes for Auxiliary Deadlocks: BHMA A156.5.

5. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
6. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
7. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.

## 2.8 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: Function numbers and descriptions indicated in door hardware sets comply with the following:

1. Bored Locks: BHMA A156.2.
2. Mortise Locks: BHMA A156.13.
3. Interconnected Locks: BHMA A156.12.

B. Bored Locks: BHMA A156.2[**, Grade 1**] [**, Grade 2**] [**, Grade 1 unless Grade 2 is indicated**]; Series 4000.[ **Listed under Category F in BHMA's "Certified Product Directory."**]

1. [**Available** ]Manufacturers:

a. Arrow USA; an ASSA ABLOY Group company.
b. Best Access Systems; Div. of The Stanley Works.
c. Cal-Royal Products, Inc.
d. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
e. Falcon Lock; an Ingersoll-Rand Company.
f. Marks USA.
g. Medeco Security Locks, Inc.; an ASSA ABLOY Group company.
h. PDQ Manufacturing.
i. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
j. Schlage Commercial Lock Division; an Ingersoll-Rand Company.
k. Security Door Controls.
l. Weiser Lock; a Masco Company.
m. Yale Commercial Locks and Hardware; an ASSA ABLOY Group company.
n. <**Insert manufacturer's name.**>

C. Mortise Locks: Stamped steel case with steel or brass parts; BHMA A156.13[**, Grade 1**] [**, Grade 2**] [**, Grade 1 unless Grade 2 is indicated**]; Series 1000.[ **Listed under Category F in BHMA's "Certified Product Directory."**]

1. [**Available** ]Manufacturers:

a. Accurate Lock & Hardware Co.
b. Adams Rite Manufacturing Co.
c. Arrow USA; an ASSA ABLOY Group company.
d. Best Access Systems; Div. of The Stanley Works.
e. Cal-Royal Products, Inc.
f. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
g. Folger Adam Security, Inc.; an ASSA ABLOY Group company.
h. Falcon Lock; an Ingersoll-Rand Company.
i. Marks USA.

j. PDQ Manufacturing.
k. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
l. Schlage Commercial Lock Division; an Ingersoll-Rand Company.
m. Security Door Controls.
n. Yale Commercial Locks and Hardware; an ASSA ABLOY Group company.
o. <**Insert manufacturer's name.**>

D. Interconnected Locks: BHMA A156.12[**, Grade 1**] [**, Grade 2**] [**, Grade 1 unless Grade 2 is indicated**]; Series 5000.[ **Listed under Category F in BHMA's "Certified Product Directory."**]

1. [**Available** ]Manufacturers:

a. Arrow USA; an ASSA ABLOY Group company.
b. Cal-Royal Products, Inc.
c. Falcon Lock; an Ingersoll-Rand Company.
d. Schlage Commercial Lock Division; an Ingersoll-Rand Company.
e. <**Insert manufacturer's name.**>

E. Roller Latches: Rolling plunger that engages socket or catch, with adjustable roller projection, and as follows:

1. Material: [**Brass**] [**Bronze**].
2. Mounting: [**Surface**] [**Mortise**].

F. Push-Pull Latches: Consisting of paddle handles that retract latchbolt; capable of being mounted vertically or horizontally; and as follows:

1. Lever and Escutcheon Material: [**Brass**] [**Bronze**] [**Stainless steel**] [**Aluminum**].
2. Latch Type: [**Bored**] [**Mortise**].
3. Lettering: Engrave with the words "Pull" and "Push."
4. Lead Lining: 0.047 inch (1.2 mm) thick for escutcheon plate.

## 2.9 AUXILIARY LOCKS AND LATCHES

A. Auxiliary Locks: BHMA A156.5[**, Grade 1**] [**, Grade 2**] [**, Grade 1 unless Grade 2 is indicated**].[ **Listed under Category E in BHMA's "Certified Product Directory."**]

1. [**Available** ]Manufacturers:

a. ABLOY Security, Inc.; an ASSA ABLOY Group company.
b. Accurate Lock & Hardware Co.
c. Adams Rite Manufacturing Co.
d. Arrow USA; an ASSA ABLOY Group company.
e. Best Access Systems; Div. of The Stanley Works.
f. Cal-Royal Products, Inc.
g. Falcon Lock; an Ingersoll-Rand Company.
h. Marks USA.
i. Medeco Security Locks, Inc.; an ASSA ABLOY Group company.
j. PDQ Manufacturing.

k. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
l. Schlage Commercial Lock Division; an Ingersoll-Rand Company.
m. Weiser Lock; a Masco Company.
n. Yale Commercial Locks and Hardware; an ASSA ABLOY Group company.
o. <**Insert manufacturer's name.**>

2. Bored Auxiliary Locks:

a. Material: [**Aluminum**] [**Brass**] [**Bronze**] [**Stainless steel**] [**Zinc alloy**].
b. Deadlatches: Deadlocking latchbolt operated by [**key either side**] [**key outside and turn inside**] [**turn inside with no cylinder**].
c. Deadlocks: Deadbolt operated by [**key either side**] [**key outside and turn inside**] [**turn inside, no cylinder**] [**key outside, no trim inside**].

3. Mortise Auxiliary Locks:

a. Material: [**Aluminum**] [**Brass**] [**Bronze**] [**Stainless steel**] [**Zinc alloy**].
b. Deadlocks: Deadbolt operated by key [**either side**] [**outside and turn inside**] [**one side**].
c. Deadlatches: Latchbolt and auxiliary deadlatch operated by key [**either side**] [**outside and turn inside**].
d. Deadlocks for Sliding Doors: Expanding- or interlocking-type deadbolt operated by key [**either side**] [**outside and turn inside**] [**one side**].
e. Deadlatches for Sliding Doors: Hook-type latchbolt operated by key [**either side**] [**outside and handle inside**].

4. Narrow Stile Auxiliary Locks:

a. Material: [**Aluminum**] [**Brass**] [**Bronze**] [**Stainless steel**] [**Zinc alloy**].
b. Deadlock: Deadlocking bolt operated as follows:

1) Operation: Key [**both sides**] [**outside and operating trim inside**].
2) Door Application: [**Swinging**] [**Sliding**] door.

c. Deadlatch: Latchbolt with auxiliary deadlatch operated by key outside and paddle or lever inside; for single swinging doors.
d. Multipoint Lock: Deadlocking bolt for pairs of swinging doors; operated as follows:

1) Operation: Key [**both sides**] [**outside and turn, lever, or knob inside**].
2) Type: [**Two**] [**Three**] point.

e. Latch/Lock: Deadbolt and latchbolt; both operated by key both sides; inside handle operates only latchbolt.

5. Rim Auxiliary Locks:

a. Material: [**Aluminum**] [**Brass**] [**Bronze**] [**Stainless steel**] [**Zinc alloy**].
b. Latchbolt: Operated by key outside and turn inside.
c. Deadlocking Latchbolt: Operated by key outside and turn inside.
d. Deadbolt: Operated by key outside and turn inside.

e. Rotary Deadbolt: Operated by key [**either side**] [**outside and turn inside**] [**outside**].
f. Interlocking Deadbolt: Operated by key [**either side**] [**outside and turn inside**] [**outside**].

B. Push-Button Combination Locks: BHMA A156.5[**, Grade 1 for cylindrical locks**] [**, Grade 2 for mortise locks**].

1. [**Available** ]Manufacturers:

a. Kaba Ilco Inc.; a Kaba Group company.
b. <**Insert manufacturer's name.**>

2. Lock opens by entering a one- to five-digit code by pushing correct buttons in correct sequence; automatically relocks when door is closed.
3. Lockset Configuration: [**Standard**] [**Privacy with inside push button**].
4. Auxiliary Lock Configuration: [**Deadbolt**] [**Deadlocking latch**] [**Deadlocking rim latch**].
5. Provide key override capability by means of cylinder.

## 2.10 ELECTROMAGNETIC LOCKS

A. General: BHMA A156.23; electrically powered, of strength and configuration indicated; with electromagnet attached to frame and armature plate attached to door.[ **Listed under Category E in BHMA's "Certified Product Directory."**]

1. Type: Full exterior or full interior, as required by application indicated.
2. Strength Ranking: [**1500 lbf (6672 N)**] [**1000 lbf (4448 N)**] [**500 lbf (2224 N)**].
3. Inductive Kickback Peak Voltage: Not more than [**53**] [**0**] V.
4. Residual Magnetism: Not more than [**4 lbf (18 N)**] [**0 lbf (0 N)**] to separate door from magnet.

B. Delayed-Egress Locks: BHMA A156.24.[ **Listed under Category G in BHMA's "Certified Product Directory."**]

1. Means of Egress Doors: Lock releases within 15 seconds after applying a force not more than 15 lbf (67 N) for not more than 3 seconds, as required by NFPA 101.
2. Security Grade: Activated from secure side of door by initiating device.
3. Movement Grade: Activated by door movement as initiating device.

C. Configuration: Direct-hold type.

1. Mounting: Lock mounted on bottom of header; strike mounted flush on push side of door.
2. Mounting: Lock mounted on face of header; strike mounted on pull side of door with angle bracket.
3. Mounting: Lock mounted on side of jamb; strike mounted flush on push side of door.

D. Configuration: Shear type.

1. Mounting: Lock mounted on face of header; strike mounted on either side of door with angle bracket.
2. Mounting: Lock mortised in header; strike mortised in top of door.
3. Mounting: Lock mortised in jamb; strike mortised in edge of door.
4. Mounting: Lock mortised in bottom of door; strike mortised in floor.
5. Mounting: Lock mortised in floor; strike mortised in bottom of door.

E. Optional Features:

1. Magnetic bond sensor.
2. Continuous housing for full width of door.
3. Continuous housing for full height of door.
4. Single LED indicators.
5. Double LED indicators.
6. Adjustable time delay with automatic relock.
7. Integral door position switch.

F. [**Available** ]Manufacturers:

1. Door Controls International.
2. Doorguard Systems, Inc.
3. Dortronics Systems, Inc.
4. DynaLock Corp.
5. Locknetics; an Ingersoll-Rand Company.
6. Rutherford Controls Int'l. Corp.
7. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
8. Securitron Magnalock Corporation; an ASSA ABLOY Group company.
9. Security Door Controls.
10. <**Insert manufacturer's name.**>

## 2.11 ELECTROMECHANICAL LOCKS

A. General: Grade [**1**] [**2**] [**1 unless Grade 2 is indicated**] for type of lock indicated; motor or solenoid driven.

B. Type: [**Bored**] [**Mortise latchbolt**] [**Mortise deadbolt**] [**Mortise deadlocking latchbolts**].

C. [**Available** ]Manufacturers:

1. ABLOY Security, Inc.; an ASSA ABLOY Group company.
2. Best Access Systems; Div. of The Stanley Works.
3. Brink, R. R. Locking Systems, Inc.
4. DynaLock Corp.
5. Folger Adam Security, Inc.; an ASSA ABLOY Group company.
6. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
7. Schlage Commercial Lock Division; an Ingersoll-Rand Company.
8. Security Door Controls.
9. Yale Commercial Locks and Hardware; an ASSA ABLOY Group company.
10. <**Insert manufacturer's name.**>

## 2.12 SELF-CONTAINED ELECTRONIC LOCKS

A. General: Internal, battery-powered, self-contained electronic locks; consisting of complete lockset, motor-driven lock mechanism, and actuating device; enclosed in zinc-dichromate-plated, wrought-steel case. Provide key override, low-battery detection and warning, LED status indicators, and ability to program at the lock; type and function indicated.

1. Type: [**Bored**] [**Mortise**].
2. Actuating Device: [**Digital keypad**] [**Magnetic-stripe card reader**].

    a. Card: [**Manufacturer's standard**] [**0.030-inch- (0.76-mm-) thick PVC or polyester**] [**Custom**].

3. Faceplate Material: [**Wrought brass**] [**Wrought bronze**] [**Stainless steel**].
4. Trim: [**Lever**] [**Knob**] [**Match trim specified for mechanical locks**].

B. Accessory: Card encoder and software.

C. Functions: [**Latch with**] [**Deadbolt with**] [**Latch without**] [**Deadbolt without**] key.

D. [**Available** ]Manufacturers:

1. Best Access Systems; Div. of The Stanley Works.
2. Cypress Computer Systems, Inc.
3. Kaba Ilco Inc.; a Kaba Group company.
4. Marks USA.
5. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
6. Schlage Commercial Lock Division; an Ingersoll-Rand Company.
7. Security Door Controls.
8. Yale Commercial Locks and Hardware; an ASSA ABLOY Group company.
9. <**Insert manufacturer's name.**>

## 2.13 EXIT LOCKS AND EXIT ALARMS

A. Exit Locks: BHMA A156.29, Grade 1, surface mounted; battery powered, housed in metal case; with red-and-white lettering reading "EMERGENCY EXIT PUSH TO OPEN--ALARM WILL SOUND."[ **Include the following features:**]

1. Low-battery alert.
2. Outside key control.
3. Audible alarm that sounds when unauthorized use of door occurs.
4. Silent alarm with remote signal capability for connection to remote indicating panel.
5. Strike: [**Surface**] [**Mortise**].
6. Single-Door Type: Activated by [**arm, push plate, or paddle**] [**horizontal bar**].
7. Pairs-of-Door Type: Activated by [**arm, push plate, or paddle**] [**horizontal bar**].

B. Stand-Alone Exit Alarms: BHMA A156.29, Grade 1, [**surface mounted on door**] [**mounted separate from door and activated by door movement switch**].[ **Include the following features:**]

1. Low-battery alert.
2. Outside key control.
3. Audible alarm that sounds when unauthorized use of door occurs.
4. Automatic rearming after authorized use[**, with adjustable time delay**].
5. Remote signal capability for connection to remote indicating panel.

C. [**Available** ]Manufacturers:

1. Arrow USA; an ASSA ABLOY Group company.
2. Detex Corporation.
3. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
4. <**Insert manufacturer's name.**>

## 2.14 DOOR BOLTS, GENERAL

A. Bolt Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Half-Round Surface Bolts: Minimum 7/8-inch (22-mm) throw.
2. Interlocking Surface Bolts: Minimum 15/16-inch (24-mm) throw.
3. Fire-Rated Surface Bolts: Minimum 1-inch (25-mm) throw; listed and labeled for fire-rated doors.
4. Dutch-Door Bolts: Minimum 3/4-inch (19-mm) throw.
5. Mortise Flush Bolts: Minimum 3/4-inch (19-mm) throw.

B. Dustproof Strikes: BHMA A156.16[**, Grade 1**].

C. Surface Bolts: BHMA A156.16[**, Grade 1**] [**, Grade 2**] [**, Grade 1 unless Grade 2 is indicated**].

1. Flush Bolt Heads: Minimum of 1/2-inch- (13-mm-) diameter rods of brass, bronze, or stainless steel with minimum 12-inch- (305-mm-) long rod for doors up to 84 inches (2134 mm) in height. Provide longer rods as necessary for doors exceeding 84 inches (2134 mm).
2. [**Available** ]Manufacturers:

a. Burns Manufacturing Incorporated.
b. Don-Jo Mfg., Inc.
c. Door Controls International.
d. Glynn-Johnson; an Ingersoll-Rand Company.
e. Hager Companies.
f. IVES Hardware; an Ingersoll-Rand Company.
g. Stanley Commercial Hardware; Div. of The Stanley Works.
h. Trimco.
i. <**Insert manufacturer's name.**>

D. Manual Flush Bolts: BHMA A156.16[**, Grade 1**] [**, Grade 2**] [**, Grade 1 unless Grade 2 is indicated**]; designed for mortising into door edge.

1. [**Available** ]Manufacturers:

a. Adams Rite Manufacturing Co.
b. Burns Manufacturing Incorporated.
c. Don-Jo Mfg., Inc.
d. Door Controls International.
e. Glynn-Johnson; an Ingersoll-Rand Company.
f. Hager Companies.
g. Hiawatha, Inc.
h. IVES Hardware; an Ingersoll-Rand Company.
i. Stanley Commercial Hardware; Div. of The Stanley Works.
j. Trimco.
k. <**Insert manufacturer's name.**>

E. Automatic and Self-Latching Flush Bolts: BHMA A156.3[**, Grade 1**] [**, Grade 2**] [**, Grade 1 unless Grade 2 is indicated**]; designed for mortising into door edge.

1. [**Available** ]Manufacturers:

a. Cal-Royal Products, Inc.
b. Door Controls International.
c. Glynn-Johnson; an Ingersoll-Rand Company.
d. Hager Companies.
e. IVES Hardware; an Ingersoll-Rand Company.
f. Trimco.
g. <**Insert manufacturer's name.**>

## 2.15 DOOR BOLTS

A. Half-Round Surface Bolts: 6-inch (152-mm) polished-brass or burnished-steel, half-round rod and knob; minimum 7/8-inch (22-mm) throw; with universal strike.

B. Interlocking Surface Bolts: 6-inch (152-mm) extruded-brass or aluminum, interlocking track and rod; minimum 15/16-inch (24-mm) throw; with universal or mortise strike.

C. Fire-Rated Surface Bolts: 8-inch (203-mm) steel bolt with 2 steel guides; minimum 1-inch (25-mm) throw; listed and labeled for fire-rated doors; with universal strike.

D. Dutch-Door Surface Bolts: Polished-brass bolt and knob, minimum 3/4-inch (19-mm) throw, with standard strike.

E. Automatic Flush Bolts: Fabricated from steel and brass components, with spring-activated bolts that automatically retract when active leaf is opened and that automatically engage when active door depresses bolt trigger[**; listed and labeled for fire-rated doors**]. Provide brass or stainless-steel cover plate, top and bottom strikes, guides, guide supports, wear plates, and shims.

F. Self-Latching Flush Bolts: Fabricated from steel and brass components, with spring-activated bolts that automatically engage when active door depresses trigger[**; listed and labeled for fire-rated doors**]. Bolts are manually retracted by a slide in the bolt face. Provide brass or stainless-steel cover plate, top and bottom strikes, guides, guide supports, wear plates, and shims.

G. Manual-Extension Flush Bolts: Fabricated from extruded brass or aluminum, with 12-inch (305-mm) rod actuated by flat lever[**; listed and labeled for fire-rated doors**]. Provide matching strike.

H. Slide Flush Bolts: Cast brass, with rod actuated by slide. Provide matching strike.

I. Tubular Bolts: Polished-brass or polished-bronze, oval turn knob and escutcheon; minimum 9/16-inch (14-mm) steel bolt with 1/2-inch (13-mm) throw.

J. Dustproof Strikes:

1. Jamb Type: Polished wrought brass, with 3/4-inch- (19-mm-) diameter, spring-tension plunger.
2. Floor Type: Polished wrought brass, with 3/4-inch- (19-mm-) diameter, spring-tension plunger.
3. Locking Floor Type: Polished wrought brass, with 3/4-inch- (19-mm-) diameter, spring-tension plunger that can be locked in the up position by rotating plunger.

## 2.16 EXIT DEVICES, GENERAL

A. Exit Devices: BHMA A156.3[**, Grade 1**] [**, Grade 2**] [**, Grade 1 unless Grade 2 is indicated**].[ **Listed under Category G in BHMA's "Certified Product Directory."**]

B. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with [**the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."**] [**ANSI A117.1.**] [**FED-STD-795, "Uniform Federal Accessibility Standards."**] <**Insert local regulation.**>

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22 N).

C. Exit Devices for Means of Egress Doors: Comply with NFPA 101. Exit devices shall not require more than 15 lbf (67 N) to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.

D. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.

E. Fire Exit Devices: Devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.

F. Fire-Exit Removable Mullions: Provide removable mullions for use with fire exit devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252. Mullions shall be used only with exit devices for which they have been tested.

G. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

1. Operation: [**Rigid**] [**Movable**] [**Movable with monitor switch**].

H. Outside Trim: [**Lever**] [**Lever with cylinder**] [**Knob**] [**Knob with cylinder**] [**Pull**] [**Pull with cylinder**] [**Thumb turn with cylinder**]; material and finish to match locksets, unless otherwise indicated.

1. Match design for locksets and latchsets, unless otherwise indicated.

I. Through Bolts: For exit devices and trim on [**metal doors**] [**non-fire-rated wood doors**] [**fire-rated wood doors**].

J. [**Available** ]Manufacturers:

1. Adams Rite Manufacturing Co.
2. Arrow USA; an ASSA ABLOY Group company.
3. Cal-Royal Products, Inc.
4. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
5. Detex Corporation.
6. Door Controls International.
7. DORMA Architectural Hardware; Member of The DORMA Group North America.
8. Dor-O-Matic; an Ingersoll-Rand Company.
9. Locknetics; an Ingersoll-Rand Company.
10. Monarch Exit Devices & Door Hardware; an Ingersoll-Rand Company.
11. Precision Hardware, Inc.
12. Rutherford Controls Int'l. Corp.
13. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
14. Von Duprin; an Ingersoll-Rand Company.
15. Yale Commercial Locks and Hardware; an ASSA ABLOY Group company.
16. <**Insert manufacturer's name.**>

## 2.17 EXIT DEVICES

A. Rim Exit Devices:

1. Type: BHMA A156.3, [**Type 1, rim**] [**Type 4, narrow stile**] [**Type 28, incorporating a deadbolt**].
2. Actuating Bar: [**Cross bar**] [**Push pad**] [**Narrow-stile push pad**].
3. Material: [**Brass**] [**Bronze**] [**Stainless steel**] [**Aluminum**] [**Wrought steel**].

B. Mortise Exit Devices:

1. Type: BHMA A156.3, [**Type 3**] [**Type 10, narrow stile**].
2. Actuating Bar: [**Cross bar**] [**Push pad**] [**Narrow-stile push pad**].
3. Material: [**Brass**] [**Bronze**] [**Stainless steel**] [**Aluminum**] [**Wrought steel**].

C. Surface Vertical-Rod Exit Devices:

1. Type: BHMA A156.3, [**Type 2**] [**Type 5, narrow stile**].
2. Actuating Bar: [**Cross bar**] [**Push pad**] [**Narrow-stile push pad**].
3. Material: [**Brass**] [**Bronze**] [**Stainless steel**] [**Aluminum**] [**Wrought steel**].

4. Configuration: [**Top and bottom rods**] [**Top rod**].

D. Concealed Vertical-Rod Exit Devices:

1. Type: BHMA A156.3, [**Type 6, narrow stile**] [**Type 7, for wood doors**] [**Type 8, for metal doors**].
2. Actuating Bar: [**Cross bar**] [**Push pad**] [**Narrow-stile push pad**].
3. Material: [**Brass**] [**Bronze**] [**Stainless steel**] [**Aluminum**] [**Wrought steel**].

E. Combination Exit Devices:

1. Type: BHMA A156.3, [**Type 9, rim and surface vertical rod**] [**Type 11, mortise and surface vertical rod**] [**Type 12, mortise and concealed vertical rod**].
2. Actuating Bar: [**Cross bar**] [**Push pad**] [**Narrow-stile push pad**].
3. Material: [**Brass**] [**Bronze**] [**Stainless steel**] [**Aluminum**] [**Wrought steel**].

F. Automatic Latching Bolts:

1. Type: BHMA A156.3, [**Type 23, concealed**] [**Type 24, surface**].
2. Material: [**Brass**] [**Bronze**] [**Stainless steel**].

G. Extension Flush Bolts:

1. Type: BHMA A156.3, [**Type 25, automatic**] [**Type 27, self-latching**].
2. Material: [**Brass**] [**Bronze**] [**Stainless steel**].

H. Electrified Exit Device Options: Types and functions indicated as follows:

1. Request-for-Exit Function: Signal initiated when push bar is actuated.
2. Delayed Egress: Depressing push bar for more than 3 seconds initiates irreversible alarm and 15-second delay for egress. Fire alarm voids 15-second delay.
3. Electric Latch Retraction: Remote signal activates continuous-duty solenoid that retracts latch.
4. Electric Locking/Unlocking: Remote signal controls locking of outside trim; complying with the following:

    a. Fail-Safe: Locked when energized, unlocked when de-energized and during power failure.
    b. Fail-Secure: Unlocked when energized, locked when de-energized and during power failure.
    c. Hold-Back Mechanism: [**Continuous-duty solenoid**] [**Magnet**].

5. Push-Bar Monitor: Signal initiated to remote alarm when push bar is actuated.
6. Push-Bar Alarm: Signal initiated to audible, battery-powered, internal alarm when push bar is actuated.

I. Electronic Exit Bars: Nonlatching electronic releasing device, activated by an adjustable capacitance sensor, with no moving parts; listed and labeled as panic exit hardware. Fabricate bar from extruded aluminum, and provide door and frame transfer device and 16 feet (4.9 m) of cord to route wiring off the door frame.

J. Extruded-Aluminum Removable Mullions: BHMA A156.3, with malleable-iron top and bottom retainers, and prepared for strikes as follows:

1. Strikes: [**Two standard recessed strikes**] [**Two monitor strikes**] [**One standard and one electric strike**].

K. Tube-Steel Removable Mullions: BHMA A156.3, with malleable-iron top and bottom retainers, and prepared for strikes as follows:

1. Strikes: [**Two standard recessed strikes**] [**Two monitor strikes**] [**One standard and one electric strike**].

## 2.18 LOCK CYLINDERS

A. Standard Lock Cylinders: BHMA A156.5[**, Grade 1**] [**, Grade 1A**] [**, Grade 2**] [**, Grade 1 unless Grade 1A is indicated**] [**, Grade 1 unless Grade 2 is indicated**].

B. High-Security Lock Cylinders: BHMA A156.30[**, Grade 1**] [**, Grade 2**] [**, Grade 3**]; [**M, mechanical**] [**E, electrical**].

1. Key Control Level: Category [**A**] [**B**] [**C**].
2. Destructive Test Level: Category [**A**] [**B**] [**C**].
3. Surreptitious Entry Resistance Level: Category [**A**] [**B**] [**C**].

C. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:

1. Number of Pins: [**Five**] [**Six**] [**Seven**].
2. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
3. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
4. Bored-Lock Type: Cylinders with tailpieces to suit locks.

    a. High-Security Grade: BHMA A156.5, Grade 1A, listed and labeled as complying with pick- and drill-resistant testing requirements in UL 437 (Suffix A).

D. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:

1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.
2. Removable Cores: Core insert, removable by use of a special key; for use only with core manufacturer's cylinder and door hardware.

E. Construction Keying: Comply with the following:

1. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.
2. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

a. Replace construction cores with permanent cores as [**indicated in keying schedule**] [**directed by Owner**].
b. Furnish permanent cores to Owner for installation.

F. Manufacturer: Same manufacturer as for locks and latches.

G. [**Available** ]Manufacturers:

1. ABLOY Security, Inc.; an ASSA ABLOY Group company.
2. Arrow USA; an ASSA ABLOY Group company.
3. ASSA, Inc.; an ASSA ABLOY Group company.
4. Best Access Systems; Div. of The Stanley Works.
5. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
6. Falcon Lock; an Ingersoll-Rand Company.
7. Medeco Security Locks, Inc.; an ASSA ABLOY Group company.
8. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
9. Schlage Commercial Lock Division; an Ingersoll-Rand Company.
10. Yale Commercial Locks and Hardware; an ASSA ABLOY Group company.
11. <**Insert manufacturer's name.**>

## 2.19 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference, and as follows:

1. No Master Key System: Cylinders are operated by change keys only.
2. Master Key System: Cylinders are operated by a change key and a master key.
3. Grand Master Key System: Cylinders are operated by a change key, a master key, and a grand master key.
4. Great-Grand Master Key System: Cylinders are operated by a change key, a master key, a grand master key, and a great-grand master key.
5. Existing System: Master key or grand master key locks to Owner's existing system.
6. Existing System: Re-key Owner's existing master key system into new keying system.
7. Keyed Alike: Key all cylinders to same change key.

B. Keys: Nickel silver.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

a. Notation: [**"DO NOT DUPLICATE."**] [**Information to be furnished by Owner.**]

2. Quantity: In addition to one extra key blank for each lock, provide the following:

a. Cylinder Change Keys: Three.
b. Master Keys: Five.
c. Grand Master Keys: Five.
d. Great-Grand Master Keys: Five.

## 2.20 KEY CONTROL SYSTEM

A. Key Control Cabinet: BHMA A156.5, Grade [**1**] [**2**]; metal cabinet with baked-enamel finish; containing key-holding hooks, labels, 2 sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers; with key capacity of [**150**] <**Insert number**> percent of the number of locks.

1. Multiple-Drawer Cabinet: Cabinet with drawers equipped with key-holding panels and key envelope storage, and progressive-type ball-bearing suspension slides. Include single cylinder lock to lock all drawers.
2. Wall-Mounted Cabinet: Cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.
3. Portable Cabinet: Tray for mounting in file cabinet, equipped with key-holding panels, envelopes, and cross-index system.

B. Cross-Index System: [**Multiple**] [**Single**]-index system for recording key information. Include three receipt forms for each key-holding hook. Set up by [**key control manufacturer**] [**Installer**].

1. [**Available** ]Manufacturers:

    a. Key Control Systems, Inc.
    b. Lund Equipment Co., Inc.
    c. MMF Industries.
    d. Sunroc Corporation.
    e. <**Insert manufacturer's name.**>

C. Key Control System Software: BHMA A156.5, Grade 1; multiple-index system for recording and reporting key-holder listings, tracking keys and lock and key history, and printing receipts for transactions. Include instruction manual.

1. [**Available** ]Manufacturers:

    a. Best Access Systems; Div. of The Stanley Works.
    b. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
    c. <**Insert manufacturer's name.**>

D. Key Lock Boxes: Designed for storage of [**two**] [**10**] <**Insert number**> keys[**, with tamper switches to connect to intrusion detection system**].

1. [**Available** ]Manufacturers:

    a. ABLOY Security, Inc.; an ASSA ABLOY Group company.
    b. Knox Company.
    c. Supra Products.
    d. <**Insert manufacturer's name.**>

## 2.21 ELECTRIC STRIKES

A. Standard: BHMA A156.31[**, Grade 1**] [**, Grade 2**] [**, Grade 1 unless Grade 2 is indicated**].

B. General: Use fail-secure electric strikes with fire-rated devices.

1. Material: [**Steel**] [**Forged stainless steel**] [**Cast stainless steel**].
2. Mounting: [**Mortised**] [**Semirim mounted**] [**Rim mounted**].
3. Monitoring: [**Mechanical latchbolt**] [**Infrared latchbolt**] [**Mechanical strike**] [**Infrared strike**].

C. [**Available** ]Manufacturers:

1. Adams Rite Manufacturing Co.
2. Brink, R. R. Locking Systems, Inc.
3. Folger Adam Security, Inc.; an ASSA ABLOY Group company.
4. HES, Inc.; an ASSA ABLOY Group company.
5. Locknetics; an Ingersoll-Rand Company.
6. Precision Hardware, Inc.
7. Rutherford Controls Int'l. Corp.
8. Security Door Controls.
9. Trine Access Technology.
10. Von Duprin; an Ingersoll-Rand Company.
11. <**Insert manufacturer's name.**>

## 2.22 OPERATING TRIM, GENERAL

A. Standard: BHMA A156.6[ **and as illustrated on Drawings**].

B. Materials: Fabricate from [**aluminum**] [**brass**] [**bronze**] [**stainless steel**], unless otherwise indicated.

C. [**Available** ]Manufacturers:

1. Burns Manufacturing Incorporated.
2. Don-Jo Mfg., Inc.
3. Forms + Surfaces.
4. Hager Companies.
5. Hiawatha, Inc.
6. IVES Hardware; an Ingersoll-Rand Company.
7. Rockwood Manufacturing Company.
8. Trimco.
9. <**Insert manufacturer's name.**>

## 2.23 OPERATING TRIM

A. Flat Push Plates: 0.050 inch (1.3 mm) thick, 4 inches wide by 16 inches high (102 mm wide by 406 mm high); with square corners and beveled edges, secured with exposed screws.

B. Cold-Forged Push Plates: 0.050 inch (1.3 mm) thick, 4 inches wide by 16 inches high (102 mm wide by 406 mm high); with square corners and beveled edges, secured with exposed screws.

C. Push-Pull Plates: 1/8 inch (3.2 mm) thick, 4 inches wide by 16 inches high (102 mm wide by 406 mm high); with square corners, beveled edges, and raised integral lip; secured with exposed screws.

D. Straight Door Pulls: 3/4-inch (19-mm) constant-diameter pull, with minimum clearance of 1-1/2 inches (38 mm) from face of door; fastened at 8 inches (203 mm) o.c.

1. Mounting: [**Surface applied with concealed fasteners**] [**Through bolted with oval-head machine screws and countersunk washers**] [**Back to back with threaded sleeves**].

E. Offset Door Pulls: 3/4-inch (19-mm) constant-diameter pull, with minimum clearance of 1-1/2 inches (38 mm) from face of door and offset of 2 inches (51 mm); fastened at 8 inches (203 mm) o.c.

1. Mounting: [**Surface applied with concealed fasteners**] [**Through bolted with oval-head machine screws and countersunk washers**] [**Back to back with threaded sleeves**].

F. Flush Door Pulls: Mortised 1/2 inch (13 mm) deep, fastened by screws, and as follows:

1. Shape: [**Circular**] [**Rectangular with oval recess**] [**Rectangular with rectangular recess**].

G. Pull-Plate Door Pulls: 0.050-inch- (1.3-mm-) thick plate, 4 inches wide by 16 inches high (102 mm wide by 406 mm high), with square corners and beveled edges; 3/4-inch (19-mm) constant-diameter pull, with minimum clearance of 1-1/2 inches (38 mm) from face of door; fastened at 8 inches (203 mm) o.c.

1. Mounting: [**Surface applied with concealed fasteners**] [**Through bolted with oval-head machine screws and countersunk washers**] [**Back to back with threaded sleeves**].

H. Straight Push-Pull Door Pulls: Push-pull plate minimum 5 inches wide by 12 inches high (125 mm wide by 300 mm high), with minimum clearance of 1-1/2 inches (38 mm) from face of door.

I. Offset Push-Pull Door Pulls: Push-pull plate minimum 5 inches wide by 12 inches high (125 mm wide by 300 mm high), with minimum clearance of 1-1/2 inches (38 mm) from face of door, and offset 2 inches (50 mm).

J. Single Push Bar: Horizontal bar, with minimum clearance of 1-1/2 inches (38 mm) from face of door, and as follows:

1. Shape and Size: [**1-inch (25-mm) constant-diameter round bar**] [**Minimum 3/8-by-1-1/4-inch (10-by-32-mm) flat bar**].
2. Mounting: [**Surface applied with concealed fasteners**] [**Through bolted with oval-head machine screws and countersunk washers**].

K. Double Pull Bar: Two horizontal bars connected by matching vertical pull bar and spaced at 8 inches (200 mm) o.c.; with minimum clearance of 1-1/2 inches (38 mm) from face of door, and as follows:

1. Shape and Size: [**1-inch (25-mm) constant-diameter round bars**] [**Minimum 3/8-by-1-1/4-inch (10-by-32-mm) flat bars**].
2. Mounting: [**Surface applied with concealed fasteners**] [**Through bolted with oval-head machine screws and countersunk washers**].

## 2.24 ACCESSORIES FOR PAIRS OF DOORS

A. Carry-Open Bars: Provide carry-open bars for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.

1. Material: Polished brass or bronze, with strike plate.

B. Flat Overlapping Astragals: Flat metal bar, surface mounted on face of door with screws; minimum 1/8 inch (3.2 mm) thick by 2 inches (50 mm) wide by full height of door; and base metal as follows:

1. Base Metal: [**Primed steel**] [**Zinc-plated steel**] [**Aluminum**] [**Stainless steel**] [**Brass**].

C. Rigid, Housed Astragals: Gasket material held in place by metal housing; fastened to face of door with screws.

1. Gasket Material: [**Closed-cell sponge silicone**] [**Closed-cell sponge neoprene**] [**Neoprene**] [**Silicone bulb**].
2. Housing Material: [**Aluminum**] [**Copper alloy (brass or bronze)**].

D. Overlapping-with-Gasket Astragals: T-shaped metal, surface mounted on edge of door with screws; with integral gasket and base metal as follows:

1. Base Metal: [**Primed steel**] [**Zinc-plated steel**] [**Aluminum**] [**Stainless steel**].
2. Gasket Material: [**Vinyl**] [**Silicone**] [**Sponge neoprene**] [**Brush pile**] [**Polypropylene**].

## 2.25 CLOSERS, GENERAL

A. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with [**the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."**] [**ANSI A117.1.**] [**FED-STD-795, "Uniform Federal Accessibility Standards."**] <**Insert local regulation.**>

1. Comply with the following maximum opening-force requirements:

a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
b. Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

B. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf (133 N) to set door in motion and not more than 15 lbf (67 N) to open door to minimum required width.

C. Hold-Open Closers/Detectors: Coordinate and interface integral smoke detector and closer device with fire alarm system.

D. Flush Floor Plates: Provide finish cover plates for floor closers unless thresholds are indicated. Match door hardware finish, unless otherwise indicated.

E. Recessed Floor Plates: Provide recessed floor plates with insert of floor finish material for floor closers unless thresholds are indicated. Provide extended closer spindle to accommodate thickness of floor finish.

F. Power-Assist Closers: As specified in Division 8 Section "Automatic Door Operators" for access doors for people with disabilities or where listed in door hardware sets.

G. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

H. Surface Closers: BHMA A156.4[**, Grade 1**] [**, Grade 2**] [**, Grade 1 unless Grade 2 is indicated**].[ **Listed under Category C in BHMA's "Certified Product Directory."**] Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated.

1. [**Available** ]Manufacturers:

    a. Arrow USA; an ASSA ABLOY Group company.
    b. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
    c. DORMA Architectural Hardware; Member of The DORMA Group North America.
    d. Dor-O-Matic; an Ingersoll-Rand Company.
    e. LCN Closers; an Ingersoll-Rand Company.
    f. Norton Door Controls; an ASSA ABLOY Group company.
    g. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
    h. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
    i. Yale Commercial Locks and Hardware; an ASSA ABLOY Group company.
    j. <**Insert manufacturer's name.**>

I. Concealed Closers: BHMA A156.4[**, Grade 1**] [**, Grade 2**] [**, Grade 1 unless Grade 2 is indicated**].[ **Listed under Category C in BHMA's "Certified Product Directory."**]

1. [**Available** ]Manufacturers:

    a. DORMA Architectural Hardware; Member of The DORMA Group North America.
    b. LCN Closers; an Ingersoll-Rand Company.
    c. Norton Door Controls; an ASSA ABLOY Group company.
    d. Rixson Specialty Door Controls; an ASSA ABLOY Group company.

e. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
f. <**Insert manufacturer's name.**>

J. Closer Holder Release Devices: BHMA A156.15.[ **Listed under Category C in BHMA's "Certified Product Directory."**]

1. Life-Safety Type: On release of hold open, door becomes self-closing. Automatic release is activated by [**smoke detection system**] [**loss of power**].
2. [**Available** ]Manufacturers:

a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
b. DORMA Architectural Hardware; Member of The DORMA Group North America.
c. LCN Closers; an Ingersoll-Rand Company.
d. Norton Door Controls; an ASSA ABLOY Group company.
e. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
f. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
g. <**Insert manufacturer's name.**>

K. Coordinators: BHMA A156.3.

## 2.26 CLOSERS

A. Traditional Surface Closers: Rack-and-pinion hydraulic type; with adjustable sweep and latch speeds controlled by key-operated valves; with forged-steel main arm; enclosed in a cast-aluminum alloy shell; complying with the following:

1. Mounting: [**Hinge side**] [**Opposite hinge side**] [**Parallel arm**] [**Bracket**].
2. Type: [**Regular arm**] [**Fusible-link holder arm**] [**Two-point hold-open arm**] [**Delayed action closing**].
3. Backcheck: [**Factory preset**] [**Adjustable**], effective between 60 and 85 degrees of door opening.

B. Modern-Type-without-Cover Surface Closers: Rack-and-pinion hydraulic type; with adjustable sweep and latch speeds controlled by key-operated valves; with forged-steel main arm; enclosed in a cast-aluminum alloy shell; complying with the following:

1. Mounting: [**Hinge side**] [**Opposite hinge side**] [**Parallel arm**] [**Bracket**] [**Hinge side top jamb**] [**Opposite side top jamb**].
2. Type: [**Regular arm**] [**Fusible-link holder arm**] [**Slide track arm**] [**Delayed action closing**].
3. Backcheck: [**Factory preset**] [**Adjustable**], effective between 60 and 85 degrees of door opening.
4. Closing Power Adjustment: At least [**50**] [**35**] [**15**] percent more than minimum tested value.

C. Modern-Type-with-Cover Surface Closers: Rack-and-pinion hydraulic type; with adjustable sweep and latch speeds controlled by key-operated valves; with forged-steel main arm; enclosed in cover indicated; complying with the following:

1. Mounting: [**Hinge side**] [**Opposite hinge side**] [**Parallel arm**] [**Bracket**] [**Hinge side, top jamb**] [**Opposite side, top jamb**].
2. Type: [**Regular arm**] [**Fusible-link holder arm**] [**Slide track arm**] [**Delayed action closing**].
3. Backcheck: [**Factory preset**] [**Adjustable**], effective between 60 and 85 degrees of door opening.
4. Cover Material: [**Aluminum**] [**Plated steel**] [**Molded plastic**].
5. Closing Power Adjustment: At least [**50**] [**35**] [**15**] percent more than minimum tested value.

D. Concealed-in-Door-Type Concealed Closers: Rack-and-pinion hydraulic type; with adjustable sweep and latch speeds controlled by key-operated valves; mortised into top rail of minimum 1-3/4-inch- (44-mm-) thick doors and track mortised into head frame; with double lever arm indicated; complying with the following:

1. Type: [**Surface shoe**] [**Mortised soffit plate**].
2. Arm: [**Regular**] [**Hold open**].
3. Closing Power Adjustment: At least [**50**] [**35**] [**15**] percent more than minimum tested value.

E. Overhead Concealed Closers: Rack-and-pinion hydraulic type; with adjustable sweep and latch speeds controlled by key-operated valves; mortised into head frame; with cast-metal body and exposed cover plate; complying with the following:

1. Type: [**Exposed arm with surface shoe, single acting**] [**Concealed arm and track, butt or pivot hung, single acting**] [**Concealed arm and track, center pivoted, single acting**] [**Concealed arm and track, center pivoted, double acting**].
2. Arm: [**Regular**] [**Automatic hold open**] [**Manually selected hold open**] [**Fusible-link holder arm**].
3. Track: [**Regular**] [**Automatic hold open**] [**Manually selected hold open**].
4. Cover Plate Material: [**Aluminum**] [**Plated steel**].
5. Backcheck: [**Factory preset**] [**Adjustable**].
6. Closing Power Adjustment: At least [**50**] [**35**] percent more than minimum tested value.

F. Floor Concealed Closers: Rack-and-pinion hydraulic type; with adjustable sweep and latch speeds controlled by key-operated valves; with cement case and cast-iron closer body case; for single-acting doors; complying with the following:

1. Type: [**Center pivoted**] [**Butt hinge hung or offset pivoted**] [**Offset pivoted**].
2. Fire Rated: Listed for use with labeled fire doors where indicated.
3. Function: [**Regular**] [**Automatic hold open**] [**Manually selected hold open**] [**Delayed action closing**].
4. Backcheck: [**Factory preset**] [**Adjustable**].
5. Closing Power Adjustment: At least [**50**] [**35**] percent more than minimum tested value.
6. Case Depth: [**Regular, 4 inches (100 mm)**] [**Shallow, 2 inches (50 mm)**].
7. Cover Plate Material: [**Aluminum**] [**Plated steel**].

G. Closer Holder Release Devices: Closer connected with separate or integral releasing and fire- or smoke-detecting devices. Door shall become self-closing on interruption of signal to release device. Comply with the following:

1. Type: [**Single-point hold open**] [**Multiple-point hold open**] [**Free-swinging release**].
2. Mounting: [**Surface mounted on face of door**] [**Surface mounted on face of top jamb**] [**Surface mounted on stop**] [**Mortised into top rail of door**] [**Mortised into top jamb**] [**Recessed into floor**].
3. Options: [**Adjustable backcheck**] [**Integral smoke detector**] [**Adjustable spring power**] [**Adjustable hold-open manual release force**].

H. Coordinators: Consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release[**; and with internal override**].

## 2.27 PROTECTIVE TRIM UNITS, GENERAL

A. Size: 1-1/2 inches (38 mm) less than door width on push side and 1/2 inch (13 mm) less than door width on pull side, by height specified in door hardware sets.

B. Fasteners: Manufacturer's standard machine or self-tapping screws.

C. Metal Protective Trim Units: BHMA A156.6; beveled top and 2 sides; fabricated from [**material indicated in door hardware sets.**] [**the following material:**]

1. Material: 0.050-inch- (1.3-mm-) thick [**aluminum**] [**brass**] [**bronze**] [**stainless steel**].
2. [**Available** ]Manufacturers:

    a. American Floor Products Co., Inc.
    b. Baldwin Hardware Corporation.
    c. Burns Manufacturing Incorporated.
    d. Don-Jo Mfg., Inc.
    e. Hager Companies.
    f. Hiawatha, Inc.
    g. IPC Door and Wall Protection Systems, Inc.; Div. of InPro Corporation.
    h. IVES Hardware; an Ingersoll-Rand Company.
    i. Pawling Corporation.
    j. Rockwood Manufacturing Company.
    k. Trimco.
    l. <**Insert manufacturer's name.**>

D. Plastic Protective Trim Units: BHMA A156.6; beveled 4 sides; fabricated from [**material indicated in door hardware sets.**] [**the following material:**]

1. Plastic Laminate: 1/8 inch (3.2 mm) thick; NEMA LD 3, Grade HGS.
2. Rigid Plastic: 0.060-inch- (1.5-mm-) thick, PVC or acrylic-modified vinyl plastic.
3. Acrylic: 1/8 inch (3.2 mm) thick.
4. Color and Texture: [**As indicated by manufacturer's designations**] [**Match Architect's sample**] [**As selected by Architect from manufacturer's full range**].
5. [**Available** ]Manufacturers:

    a. American Floor Products Co., Inc.
    b. Balco, Inc.
    c. Burns Manufacturing Incorporated.

d. Construction Specialties, Inc.; a C/S Group Company.
e. Don-Jo Mfg., Inc.
f. Hager Companies.
g. Hiawatha, Inc.
h. IPC Door and Wall Protection Systems, Inc.; Div. of InPro Corporation.
i. IVES Hardware; an Ingersoll-Rand Company.
j. Korogard Wall Protection Systems; Div. of RJF International Corporation.
k. Pawling Corporation.
l. Rockwood Manufacturing Company.
m. Tepromark International, Inc.
n. Trimco.
o. <**Insert manufacturer's name.**>

## 2.28 PROTECTIVE TRIM UNITS

A. Armor Plates: 36 inches (914 mm) high by door width, with allowance for frame stops.

B. Kick Plates: 12 inches (305 mm) high by door width, with allowance for frame stops.

C. Mop Plates: 6 inches (152 mm) high by 1 inch (25 mm) less than door width.

D. Stretcher Plates: 8 inches (203 mm) high by door width, with allowance for frame stops.

E. Nonmortise Angle Door Edging: Minimum 0.050-inch- (1.3-mm-) thick metal sheet formed into angle shape; with 1-1/4-inch (32-mm) length of leg on face of door; surface mounted on door.

1. Leg Offset: For [**0.050-inch- (1.3-mm-) thick metal**] [**1/8-inch- (3.2-mm-) thick plastic**] plate.
2. Material: [**Aluminum**] [**Brass**] [**Bronze**] [**Stainless steel**].
3. Height: [**48 inches (1220 mm)**] [**42 inches (1067 mm)**].

F. Mortise Angle Door Edging: Minimum 0.050-inch- (1.3-mm-) thick metal sheet formed into angle shape; with 7/8-inch (22-mm) length of leg on face of door; mortised into edge of door.

1. Material: [**Aluminum**] [**Brass**] [**Bronze**] [**Stainless steel**].
2. Height: [**48 inches (1220 mm)**] [**42 inches (1067 mm)**].

G. Nonmortise Cap Door Edging: Minimum 0.050-inch- (1.3-mm-) thick metal sheet formed into "U" shape; with 1-1/4-inch (32-mm) length of leg on faces of door; surface mounted on door.

1. Leg Offset: For [**0.050-inch- (1.3-mm-) thick metal**] [**1/8-inch- (3.2-mm-) thick plastic**] plate.
2. Material: [**Aluminum**] [**Brass**] [**Bronze**] [**Stainless steel**].
3. Height: [**48 inches (1220 mm)**] [**42 inches (1067 mm)**].

H. Mortise Cap Door Edging: Minimum 0.050-inch- (1.3-mm-) thick metal sheet formed into "U" shape; with 7/8-inch (22-mm) length of leg on faces of door; mortised into edge of door.

1. Material: [**Aluminum**] [**Brass**] [**Bronze**] [**Stainless steel**].

2. Height: [**48 inches (1220 mm)**] [**42 inches (1067 mm)**].

2.29 STOPS AND HOLDERS, GENERAL

A. Stops and Bumpers: BHMA A156.16[**, Grade 1**] [**, Grade 2**] [**, Grade 1 unless Grade 2 is indicated**].

1. Provide floor stops for doors unless wall or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic. Where floor or wall stops are not appropriate, provide overhead holders.

B. Mechanical Door Holders: BHMA A156.16[**, Grade 1**] [**, Grade 2**] [**, Grade 1 unless Grade 2 is indicated**].

C. Combination Floor and Wall Stops and Holders: BHMA A156.8[**, Grade 1**] [**, Grade 2**] [**, Grade 1 unless Grade 2 is indicated**].

D. Combination Overhead Stops and Holders: BHMA A156.8[**, Grade 1**] [**, Grade 2**] [**, Grade 1 unless Grade 2 is indicated**].

E. Electromagnetic Door Holders: Coordinate with fire detectors and interface with fire alarm system for labeled fire door assemblies.

1. Listed under Category C in BHMA's "Certified Product Directory."

F. Silencers for Wood Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum 5/8 by 3/4 inch (16 by 19 mm); fabricated for drilled-in application to frame.

G. Silencers for Metal Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum diameter 1/2 inch (13 mm); fabricated for drilled-in application to frame.

H. [**Available** ]Manufacturers:

1. Architectural Builders Hardware Mfg., Inc.
2. Baldwin Hardware Corporation.
3. Burns Manufacturing Incorporated.
4. Cal-Royal Products, Inc.
5. Don-Jo Mfg., Inc.
6. Door Controls International.
7. DORMA Architectural Hardware; Member of The DORMA Group North America.
8. Dor-O-Matic; an Ingersoll-Rand Company.
9. Glynn-Johnson; an Ingersoll-Rand Company.
10. Hager Companies.
11. HES, Inc.; an ASSA ABLOY Group company.
12. Hiawatha, Inc.
13. IVES Hardware; an Ingersoll-Rand Company.
14. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
15. Rockwood Manufacturing Company.
16. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
17. Stanley Commercial Hardware; Div. of The Stanley Works.

18. Trimco.
19. <**Insert manufacturer's name.**>

## 2.30 STOPS AND HOLDERS

A. Chain Door Stops: Welded chain, each end attached to compression springs, both covered with protective sleeve; surface-screw application.

B. Rigid Wall Stops: Polished cast brass, bronze, or aluminum; 3-1/2 inches (89 mm) long, with rubber bumper; [**surface-screw**] [**expansion-shield**] application.

C. Wall Bumpers: Polished cast brass or aluminum with rubber bumper; 2-1/2-inch (64-mm) diameter, minimum 3/4-inch (19-mm) projection from wall, with backplate for concealed fastener installation; with [**convex**] [**concave**] bumper configuration.

D. Roller-Type Bumpers: Polished cast brass or bronze; minimum 4-3/8-inch (111-mm) projection from wall; attached by surface screws.

E. Rigid Floor Stops: Polished cast brass, bronze, or aluminum, with rubber bumper; [**surface-screw**] [**expansion-shield**] application.

F. Dome-Type Floor Stops: Polished cast brass, bronze, or aluminum, with rubber bumper; and as follows:

1. Height: Minimum [**1 inch (25 mm) high, for doors without threshold**] [**1-3/8 inches (35 mm) high, for doors with threshold**].
2. Riser: Extruded aluminum for carpet installations.

G. Lever-Type Door Holders: Polished cast brass, bronze, or aluminum; minimum 4-inch- (102-mm-) long arm that swings up and remains in vertical position; with replaceable rubber tip; surface-screw application.

H. Plunger-Type Door Holders: Polished cast brass, bronze, or aluminum; minimum 1-1/8-inch (29-mm) plunger throw; with replaceable rubber tip; surface-screw application.

I. Electromagnetic Door Holders: BHMA A156.15, Grade 1; electromagnet attached to wall or floor as indicated, and strike plate attached to swinging door.

1. Configuration: [**Wall-mounted single**] [**Floor-mounted single**] [**Floor-mounted double**] unit.

J. Combination Floor Stop and Holders: Polished cast brass, bronze, or aluminum; encased spring bumper with metal plunger and stop; and as follows:

1. Operation: [**Semiautomatic hold open**] [**Automatic hold open and release by pushing door**].
2. Application: [**Surface screw**] [**Expansion shield**].

K. Manual Combination Floor Stop and Holders: Polished cast brass, bronze, or aluminum; 3-1/2 inches (89 mm) long, with holder, keeper, and rubber bumper; [**surface-screw**] [**expansion-shield**] application.

L. Combination Wall Stop and Holders: Polished cast brass, bronze, or aluminum; encased spring bumper with metal plunger and stop; surface-screw application; and as follows:

1. Operation: [**Semiautomatic hold open**] [**Automatic hold open and release by pushing door**].

M. Manual Combination Wall Stop and Holders: Polished cast brass, bronze, or aluminum; 3-1/2 inches (89 mm) long, with holder, keeper, and rubber bumper; [**surface-screw**] [**expansion-shield**] application.

## 2.31 OVERHEAD STOPS AND HOLDERS

A. Overhead Concealed Slide Holders: BHMA A156.8, Type 1; hold open and release by push and pull of door unless control is set in inactive position; with stop and shock absorber; adjustable holding pressure; for [**single**] [**double**]-acting doors opening 110 degrees.

B. Overhead Concealed Slide Stops: BHMA A156.8, Type 1; release by push and pull of door unless control is set in inactive position; with stop and shock absorber; adjustable holding pressure; for [**single**] [**double**]-acting doors opening 110 degrees.

C. Overhead Surface-Mounted Slide Holders: BHMA A156.8, Type 2; hold open and release by push and pull of door unless control is set in inactive position; with stop and shock absorber; adjustable holding pressure; for single-acting doors opening 110 degrees.

D. Overhead Surface-Mounted, Concealed Slide Stops: BHMA A156.8, Type 2; release by push and pull of door unless control is set in inactive position; with stop and shock absorber; adjustable holding pressure; for single-acting doors opening 110 degrees.

E. Overhead Surface-Mounted, Jointed-Arm Holders: BHMA A156.8, Type 3; hold open and release by push and pull of door; control capable of being set in inactive position; with stop and shock absorber; for single-acting doors opening 110 degrees.

F. Overhead Surface-Mounted, Jointed-Arm Stops: BHMA A156.8, Type 3; release by push and pull of door; control capable of being set in inactive position; with stop and shock absorber; for single-acting doors opening 110 degrees.

G. Overhead Concealed, Friction Slide Holders: BHMA A156.8, Type 4; consisting of frictional element held under adjustable pressure; with free-acting shoulder pivots and shock absorber; for [**single**] [**double**]-acting doors opening 110 degrees.

H. Overhead Concealed, Nonfriction Slide Stops: BHMA A156.8, Type 4; consisting of nonfrictional element held under adjustable pressure; with shock absorber; for [**single**] [**double**]-acting doors opening 110 degrees.

I. Overhead Concealed, Nonfriction Slide Holders: BHMA A156.8, Type 4; consisting of nonfrictional element held under adjustable pressure; with automatic hold-open and shock absorber; for [**single**] [**double**]-acting doors opening 110 degrees.

J. Overhead Surface-Mounted, Friction Slide Holders: BHMA A156.8, Type 5; consisting of frictional element held under adjustable pressure; with free-acting shoulder pivots and shock absorber; for single-acting doors opening 110 degrees.

K. Overhead Surface-Mounted, Nonfriction Slide Stops: BHMA A156.8, Type 5; consisting of nonfrictional element held under adjustable pressure; with shock absorber; for single-acting doors opening 110 degrees.

L. Overhead Surface-Mounted, Nonfriction Slide Holders: BHMA A156.8, Type 5; consisting of nonfrictional element held under adjustable pressure; with automatic hold-open and shock absorber; for single-acting doors opening 110 degrees.

M. Overhead Surface-Mounted Rod Holders: BHMA A156.8, Type 8; hold open and release by push and pull of door unless roller cam is set in inactive position; with stop and shock absorber; adjustable spring tension; for single-acting doors opening 110 degrees.

N. Overhead Surface-Mounted Rod Stops: BHMA A156.8, Type 8; release by push and pull of door unless roller cam is set in inactive position; with stop and shock absorber; adjustable spring tension; for single-acting doors opening 110 degrees.

O. Overhead Surface-Mounted Cantilever Holders: BHMA A156.8, Type 9; hold open and release by push and pull of door or thumb turn; with stop and shock absorber; for single-acting doors opening 110 degrees.

P. Overhead Surface-Mounted Cantilever Stops: BHMA A156.8, Type 9; release by push and pull of door or thumb turn; with stop and shock absorber; for single-acting doors opening 110 degrees.

## 2.32 DOOR GASKETING, GENERAL

A. Standard: BHMA A156.22.[ **Listed under Category J in BHMA's "Certified Product Directory."**]

B. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
3. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

C. Air Leakage: Not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.

D. Smoke-Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke-control ratings indicated, based on testing according to UL 1784.

1. Provide smoke-labeled gasketing on 20-minute-rated doors and on smoke-labeled doors.

E. Fire-Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to [**NFPA 252**] [**UBC Standard 7-2**].

1. Test Pressure: [**Test at atmospheric pressure**] [**After 5 minutes into the test, neutral pressure level in furnace shall be established at 40 inches (1016 mm) or less above the sill**].

F. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.

G. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

H. Gasketing Materials: ASTM D 2000 and AAMA 701/702.

I. [**Available** ]Manufacturers:

1. Hager Companies.
2. M-D Building Products, Inc.
3. National Guard Products.
4. Pemko Manufacturing Co.
5. Reese Enterprises.
6. Sealeze; a Unit of Jason Incorporated.
7. Zero International.
8. <**Insert manufacturer's name.**>

## 2.33 DOOR GASKETING

A. Adhesive-Backed Perimeter Gasketing: Gasket material applied to frame rabbet with self-adhesive.

1. Gasket Material: [**Vinyl bulb**] [**Sponge silicone**] [**Silicone**] [**Neoprene bulb**] [**Sponge neoprene**].

B. Spring-Metal Perimeter Gasketing: Metal gasket material fastened to frame rabbet with nails or screws.

1. Gasket Material: Minimum [**0.008-inch- (0.20-mm-) thick brass or bronze**] [**0.008-inch- (0.20-mm-) thick stainless steel**] [**0.012-inch- (0.30-mm-) thick aluminum**].

C. Rigid, Housed, Perimeter Gasketing: Gasket material held in place by metal housing; fastened to frame stop with screws.

1. Gasket Material: [**Sponge silicone**] [**Sponge neoprene**] [**Silicone bulb**] [**Polyurethane bulb**] [**Vinyl bulb**] [**Vinyl brush**] [**Nylon brush**] [**Thermoplastic elastomer**].
2. Housing Material: [**Aluminum**] [**Brass or bronze**] [**Stainless steel**].

D. Adjustable, Housed, Perimeter Gasketing: Screw-adjustable gasket material held in place by metal housing; fastened to frame stop with screws.

1. Gasket Material: [**Sponge silicone**] [**Sponge neoprene**] [**Silicone bulb**] [**Polyurethane bulb**] [**Vinyl bulb**] [**Vinyl brush**] [**Nylon brush**] [**Thermoplastic elastomer**].
2. Housing Material: [**Aluminum**] [**Brass or bronze**] [**Stainless steel**].

E. Interlocking Perimeter Gasketing: Metal gasket material consisting of two pieces, one fastened to door and one fastened to frame, that interlock when door is closed; mounted with screws.

1. Gasket Material: Minimum [**0.018-inch- (0.46-mm-) thick zinc**] [**0.015-inch- (0.38-mm-) thick bronze**].

F. Overlapping Astragals for Meeting Stiles: Gasket material held in place by metal housing and overlapping when doors are closed; mounted to face of meeting stile with screws.

1. Gasket Material: [**EPDM strip**] [**Vinyl strip**] [**Nylon brush**].
2. Housing Material: [**Aluminum**] [**Bronze**].
3. Mounting: Surface mounted to [**each**] [**one**] door.

G. Meeting Astragals for Meeting Stiles: Gasket material held in place by metal housing; mounted with screws.

1. Gasket Material: [**Silicone bulb**] [**Neoprene bulb**] [**Vinyl bulb**] [**Nylon brush**] [**Brush pile**] [**Thermoplastic elastomer**].
2. Housing Material: [**Aluminum**] [**Bronze**].
3. Mounting: [**Surface mounted on face of each door**] [**Surface mounted on face of one door**] [**Semimortised into edge of each door**] [**Semimortised into edge of one door**] [**Mortised into edge of each door**] [**Mortised into edge of one door**].

H. Adjustable Astragals for Meeting Stiles: Screw-adjustable gasket material held in place by metal housing; mounted with screws.

1. Gasket Material: [**Silicone**] [**Neoprene**] [**Vinyl**] [**Vinyl-covered magnet**] [**Brush pile**] [**Thermoplastic elastomer**].
2. Housing Material: [**Aluminum**] [**Bronze**].
3. Mounting: [**Surface mounted on face**] [**Semimortised into edge**] [**Mortised into edge**] of each door.

I. Door Sweeps: Gasket material held in place by flat metal housing or flange; surface mounted to face of door with screws.

1. Gasket Material: [**Neoprene**] [**Vinyl**] [**Nylon brush**] [**Polyurethane**] [**Silicone**].
2. Housing Material: [**Aluminum**] [**Bronze**].

J. Door Shoes: Gasket material held in place by metal housing; mounted to bottom edge of door with screws.

1. Gasket Material: [**Vinyl**] [**Thermoplastic elastomer**] [**Neoprene**] [**Brush pile**].
2. Housing Material: [**Aluminum**] [**Bronze**].
3. Extended Housing: [**One side**] [**Both sides**] of door.
4. Mounting: [**Surface mounted on**] [**Mortised into**] bottom edge of door.

K. Automatic Door Bottoms: Gasket material held in place by metal housing that automatically drops to form seal when door is closed; mounted to bottom edge of door with screws.

1. Gasket Material: [**Sponge neoprene**] [**Sponge silicone**] [**Thermoplastic elastomer**] [**Nylon brush**].
2. Housing Material: [**Aluminum**] [**Bronze**] [**Aluminum with 0.047-inch (1.2-mm) lead lining**].
3. Mounting: [**Surface mounted on face**] [**Semimortised into bottom**] [**Mortised into bottom**] of door.
4. Type: Low-closing-force type for doors required to meet accessibility requirements.

## 2.34 THRESHOLDS, GENERAL

A. Standard: BHMA A156.21.[ **Listed under Category J in BHMA's "Certified Product Directory."**]

B. Accessibility Requirements: Where thresholds are indicated to comply with accessibility requirements, comply with [**the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."**] [**ANSI A117.1.**] [**FED-STD-795, "Uniform Federal Accessibility Standards."**] <**Insert local regulation.**>

1. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than [**1/2 inch (13 mm) high**] [**3/4 inch (19 mm) high for exterior sliding doors**].

C. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2 inch (13 mm) high.

D. [**Available** ]Manufacturers:

1. Hager Companies.
2. M-D Building Products, Inc.
3. National Guard Products.
4. Pemko Manufacturing Co.
5. Reese Enterprises.
6. Rixson Specialty Door Controls; an ASSA ABLOY Group company.
7. Sealeze; a Unit of Jason Incorporated.
8. Zero International.
9. <**Insert manufacturer's name.**>

## 2.35 THRESHOLDS

A. Compressing-Top Thresholds: Metal member with compressible vinyl seal on top of threshold that seals against bottom of door; and base metal of [**aluminum**] [**extruded bronze**] [**stainless steel**].

B. Saddle Thresholds: Type and base metal as follows:

1. Type: [**Smooth top**] [**Fluted top**] [**Fluted top and offset**] [**Thermal break and fluted top**] [**Applied gasketed stop and fluted top**] [**Carpet separator with fluted top**].
2. Base Metal: [**Aluminum**] [**Extruded bronze**] [**Stainless steel**].

C. Half-Saddle Thresholds: Fluted-top metal member; and base metal of [**aluminum**] [**extruded bronze**].

D. Interlocking Thresholds: Fluted-top metal member with integral lip designed to engage a hook strip applied to door; type and base metal as follows:

1. Type: [**Single lip**] [**Double lip**] [**Double-lip water return**] [**Double-lip water return with aluminum pan**] [**Single lip with thermal barrier**].
2. Base Metal: [**Aluminum**] [**Extruded bronze**].

E. Latching/Rabbeted Thresholds: Type and base metal as follows:

1. Type: [**Fluted**] [**Smooth**] [**Offset with fluted**] top.
2. Base Metal: [**Aluminum**] [**Extruded bronze**].

F. Latching/Rabbeted Thresholds with Gasket: Fluted-top metal member with gasket; type and base metal as follows:

1. Type: [**Offset**] [**Thermal barrier**].
2. Base Metal: [**Aluminum**] [**Extruded bronze**].
3. Gasket Material: [**Vinyl**] [**Silicone**] [**Neoprene**] [**Brush pile**] [**Closed-cell sponge neoprene**].

G. Plate Thresholds: Solid metal plate; and base metal as follows:

1. Top Surface: [**Fluted**] [**Fluted with slip-resistant abrasive**].
2. Base Metal: [**Aluminum**] [**Extruded brass or bronze**] [**Stainless steel**].

H. Ramped Thresholds: Modular, interlocking, sloped, fluted-top metal assemblies with closed return ends; 1:12 slope; and base metal as follows:

1. Top Surface: [**Fluted**] [**Fluted with slip-resistant abrasive**].
2. Base Metal: [**Aluminum**] [**Extruded bronze**].

I. Saddle Thresholds for Floor Closers: Fluted top; type and base metal as follows:

1. Type: [**Type A, for center-hung doors; ends not mitered**] [**Type B, for offset-hung doors; ends not mitered**] [**Type C, for center-hung doors; ends mitered**] [**Type D, for offset-hung doors; ends mitered**].
2. Base Metal: [**Aluminum**] [**Extruded bronze**].

## 2.36 SLIDING DOOR HARDWARE, GENERAL

A. General: BHMA A156.14; consisting of complete sets including rails, hangers, supports, bumpers, floor guides, and accessories indicated.

1. Exterior Door Hardware: Galvanized steel or anodized aluminum.

B. Horizontal Sliding Door Hardware: Grade 1; rated for minimum door weight of [**240 lb (109 kg)**] [**320 lb (145 kg)**] [**450 lb (205 kg)**] [**560 lb (254 kg)**] [**640 lb (290 kg)**] [**800 lb (363 kg)**] [**1000 lb (455 kg)**] [**1500 lb (681 kg)**].

C. Bypassing Sliding Door Hardware: Rated for doors weighing up to [**200 lb (91 kg)**] [**125 lb (57 kg)**] [**75 lb (34 kg)**].

D. Pocket Sliding Door Hardware: Rated for doors weighing up to [**200 lb (91 kg)**] [**125 lb (57 kg)**] [**75 lb (34 kg)**].

E. [**Available** ]Manufacturers:

1. Cox, Arthur & Sons, Inc.
2. Hager Companies.
3. Henderson, P. C. Inc.; Div. of Hepworth PLC.
4. Johnson, L. E. Products, Inc.
5. Lawrence Brothers, Inc.
6. Stanley Commercial Hardware; Div. of The Stanley Works.
7. <**Insert manufacturer's name.**>

## 2.37 SLIDING DOOR HARDWARE

A. Horizontal Sliding Door Hardware: Wrought steel, unless otherwise indicated.

1. Box Rail: [**Without mounting brackets**] [**With attached mounting brackets**] [**With attached flashing**].
2. Round Rail: [**Without**] [**With attached**] mounting brackets.
3. Rail Supports:

    a. Single Side-Wall Style: [**Intermediate**] [**End**] [**Splice**] type.
    b. Double Side-Wall Style: [**Intermediate**] [**End**] [**Splice**] type.
    c. Triple Side-Wall Style: [**Intermediate**] [**End**] [**Splice**] type.
    d. Single Overhead Style: [**Intermediate**] [**End**] [**Splice**] type.
    e. Single Overhead Parallel Style: [**Intermediate**] [**Splice**] type.
    f. Single Overhead Cross-Ear Style: [**Intermediate**] [**Splice**] type.
    g. Double Overhead Cross-Ear Style: [**Intermediate**] [**Splice**] type.
    h. Triple Overhead Cross-Ear Style: [**Intermediate**] [**Splice**] type.

4. Hanger Configuration: Four-wheel [**truck**] [**hanger assembly with top mounting plate**] [**hanger assembly with drop bolt**] [**hanger assembly with single drop strap**] [**hanger assembly with double drop strap**].

    a. Wheel Assembly: Steel wheels with ball bearings.

5. Accessories:

    a. Continuous bottom guide.
    b. Guide rail.
    c. Bow Handle: Minimum 6 inches (150 mm) in overall length.

d. Flush Pull: Minimum 4 by 5-1/2 by 3/4 inch (100 by 140 by 19 mm), mortised into door.
e. Cane Bolt: Minimum 1/2-inch (13-mm) diameter by 12 inches (305 mm) long.
f. Stay Roller: Minimum 2-inch- (50-mm-) diameter wheel.
g. Floor Center Stop: Cast iron.
h. End guide and stop.
i. Parallel door floor guides.
j. Door stop.
k. Sliding door latch.
l. Bumper Shoe: Minimum 0.0598-inch (1.5-mm) thickness.
m. Cremone Bolt: With lever handle, minimum 1/2-inch- (13-mm-) diameter oval or round rod, and rod guides at 24 inches (610 mm) o.c.
n. Top Spring Bolt: Malleable iron; with angle or surface strike and 24-inch (610-mm) chain.
o. Foot Bolt: Wrought steel, cast iron, or malleable iron; minimum [**6 inches (150 mm)**] [**8 inches (200 mm)**].

B. Bypassing Sliding Door Hardware: Rails and door hardware that allow vertical adjustment.

1. Rail Material: [**Galvanized wrought steel**] [**Extruded aluminum**].
2. Rail Configuration: [**V-grooved double leg**] [**V-grooved double leg with fascia**] [**I-beam**].
3. Mounting: [**Top hung**] [**Bottom supporting with overhead guide**].
4. Wheel Assembly: Two wheel or four wheel, with [**ball**] [**roller**] bearings.
5. Wheel Material: [**Steel**] [**Nylon**].
6. Accessories:

a. Bumper Stops: Wrought steel.
b. Pulls: [**Flush, mortised into door**] [**Cast, forged, or extruded brass or bronze surface-applied type**] [**Wrought brass or bronze edge type, mortised into edge of door**] [**Sliding door latch**] [**Sliding door lock with emergency release**].

C. Pocket Sliding Door Hardware: Overhead box rails and door hardware that allows vertical adjustment.

1. Rail Material: [**Galvanized wrought steel**] [**Extruded aluminum**].
2. Door Type: [**Single**] [**Biparting**].
3. Rail Configuration: [**V-grooved double leg**] [**I-beam**].
4. Wheel Assembly: Two wheel or four wheel, with [**ball**] [**roller**] bearings.
5. Wheel Material: [**Steel**] [**Nylon**].
6. Accessories:

a. Bumper Stops: Wrought steel.
b. Pulls: [**Flush, mortised into door**] [**Cast, forged, or extruded brass or bronze surface-applied type**] [**Wrought brass or bronze edge type, mortised into edge of door**] [**Sliding door latch**] [**Sliding door lock with emergency release**].

## 2.38 FOLDING DOOR HARDWARE, GENERAL

A. General: BHMA A156.14; consisting of complete sets including overhead rails, hangers, supports, bumpers, floor guides, and accessories indicated.

1. Interior Doors: Provide door hardware for interior bifolding doors when not furnished as part of door package.

B. Bifolding Door Hardware: Rated for door panels weighing up to [**125 lb (57 kg)**] [**50 lb (23 kg)**].

C. Multiple Folding Door Hardware: Rated for door panels weighing up to [**75 lb (34 kg)**] [**30 lb (14 kg)**].

D. [**Available** ]Manufacturers:

1. Cox, Arthur & Sons, Inc.
2. Hager Companies.
3. Henderson, P. C. Inc.; Div. of Hepworth PLC.
4. Johnson, L. E. Products, Inc.
5. Lawrence Brothers, Inc.
6. Stanley Commercial Hardware; Div. of The Stanley Works.
7. <**Insert manufacturer's name.**>

## 2.39 FOLDING DOOR HARDWARE

A. Bifolding Door Hardware: Rails and door hardware that allow horizontal and vertical adjustment.

1. Rail Material: [**Galvanized wrought steel**] [**Extruded aluminum**].
2. Rail Configuration: [**V-grooved double leg**] [**V-grooved double leg with fascia**] [**I-beam**].
3. Mounting: [**Surface mounted overhead**] [**Top and bottom hung**].
4. Wheel Assembly: Two wheel or four wheel, with [**ball**] [**roller**] bearings.
5. Wheel Material: [**Steel**] [**Nylon**].

B. Multiple Folding Door Hardware: Rails and door hardware that allows horizontal and vertical adjustment.

1. Rail Material: [**Galvanized wrought steel**] [**Extruded aluminum**].
2. Rail Configuration: [**V-grooved double leg**] [**V-grooved double leg with fascia**] [**I-beam**].
3. Mounting: [**Surface mounted overhead**] [**Top and bottom hung**].
4. Wheel Assembly: Two wheel or four wheel, with [**ball**] [**roller**] bearing.
5. Wheel Material: [**Steel**] [**Nylon**].

2.40 MISCELLANEOUS DOOR HARDWARE, GENERAL

A. Boxed Power Supplies: Modular unit in NEMA ICS 6, Type 4 enclosure; filtered and regulated; voltage rating and type matching requirements of door hardware served; and listed and labeled for use with fire alarm systems.

B. Monitor Strikes: [**Cast strike with toggle**] [**Dustbox monitor for installation under standard strike**].

C. Auxiliary Hardware: BHMA A156.16[**, Grade 1**] [**, Grade 2**] [**, Grade 1 unless Grade 2 is indicated**] [**, Grade 3**].

1. [**Available** ]Manufacturers:

a. Baldwin Hardware Corporation.
b. Cal-Royal Products, Inc.
c. Don-Jo Mfg., Inc.
d. Hager Companies.
e. Lawrence Brothers, Inc.
f. Rockwood Manufacturing Company.
g. Stanley Commercial Hardware; Div. of The Stanley Works.
h. Trimco.
i. <**Insert manufacturer's name.**>

2.41 MISCELLANEOUS DOOR HARDWARE

A. Cardholders: Cast rectangular holder, surface mounted, size as indicated:

1. Card Size: [**2 by 3-1/2 inches (51 by 89 mm)**] [**3-1/2 by 5 inches (89 by 127 mm)**] [**5 by 8 inches (127 by 203 mm)**].
2. Material: [**Brass**] [**Bronze**] [**Stainless steel**].

B. Chain Door Guards: Polished cast brass or bronze or extruded brass; consisting of plate slotted to receive 6-inch- (150-mm-) long welded chain secured to an anchor plate. Guard shall allow door to be opened 3 inches (75 mm) with chain engaged in slotted plate. Equip with chain holder.

C. Coat Hooks: Two curved hooks with rounded ends; 3-inch (76-mm) projection from wall; surface-screw applied; fabricated from [**polished cast brass**] [**polished cast bronze**] [**burnished cast aluminum**].

D. Rod-Type Door Guards: Straight door-mounted rod that engages U-shaped, jamb-mounted rod. U-shaped rod can swing 180 degrees away from door; guard allows door to be slightly opened when engaged. Fabricated from polished cast [**brass**] [**bronze**] [**aluminum**].

E. Door Knockers: BHMA A156.16, Grade 1; solid brass[**, with engraved number and nameplates**].

F. Door Position Switches: Magnetically operated reed switch designed for concealed mounting.

G. Garment Hooks: One long hat hook and one small coat hook; 3-3/4-inch (95-mm) projection from wall with 7-inch (178-mm) overall height; surface-screw applied; fabricated from [**polished cast brass**] [**burnished cast aluminum**].

H. House Numbers: BHMA A156.16, Grade 1; wrought, cast, or forged brass; 4 inches (102 mm) high; secured with brass screws.

I. Letter Box Plates: Spring-loaded front plate with brass spring; inside covered gravity flap or hood; fabricated from [**wrought brass**] [**wrought bronze**] [**aluminum**]; of the following type:

1. Regular Size, Inswinging: Minimum 0.036-inch (0.9-mm) metal thickness, with minimum 7-by-1-5/8-inch (178-by-41-mm) opening.
2. Regular Size, Outswinging: Minimum 0.036-inch (0.9-mm) metal thickness, with minimum 7-by-1-1/2-inch (178-by-38-mm) opening.
3. Magazine Size, Outswinging: Minimum 0.051-inch (1.3-mm) metal thickness, with minimum 11-by-1-7/8-inch (279-by-48-mm) opening.

J. Door and Frame Transfer Devices: Steel housing for mortise in hinge stile of door, with flexible tube for wiring bundle; accommodating doors that swing open to 120 degrees.

K. Wide-Angle Door Viewers: Solid brass, with optical glass lenses; adjustable to door thickness, and permitting 1-way observation with minimum 190-degree viewing angle.

L. Fire-Rated Door Viewers: Solid brass, with optical glass lenses; listed and labeled; adjustable to door thickness, and permitting 1-way observation with minimum [**120**] [**150**] [**190**]-degree viewing angle.

## 2.42 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.

C. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means

of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

2. Steel Machine or Wood Screws: For the following fire-rated applications:

   a. Mortise hinges to doors.
   b. Strike plates to frames.
   c. Closers to doors and frames.

3. Steel Through Bolts: For the following fire-rated applications unless door blocking is provided:

   a. Surface hinges to doors.
   b. Closers to doors and frames.
   c. Surface-mounted exit devices.

4. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
5. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."

## 2.43 FINISHES

A. Standard: BHMA A156.18, as indicated in door hardware sets.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 Series.

1. Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI A250.6.

B. Wood Doors: Comply with DHI A115-W Series.

## 3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated [**on Drawings**] [**as follows**] unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."
3. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

D. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, [**above accessible ceilings**] [**in equipment room**]. Verify location with Architect.

1. Configuration: Provide one power supply for each door opening.
2. Configuration: Provide the least number of power supplies required to adequately serve doors with electrified door hardware.

E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

## 3.4 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

## 3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
3. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

B. Occupancy Adjustment: Approximately [**three**] [**six**] <**Insert number**> months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust, including adjusting operating forces, each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

## 3.6 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

## 3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 1 Section "Demonstration and Training."

## 3.8 DOOR HARDWARE SETS

PRIVATE tbl1

Door Hardware Set No. <**Insert number**>

Door No. <**Insert designation(s)**>; each to have the following:

| No. | Item | Description | Finish |
|---|---|---|---|
| * | Hanging Devices | <**Insert description.**> | <**Insert finish.**> |
| [#] | Securing Devices (inactive leaf) | <**Insert description.**> | <**Insert finish.**> |
| [#] | Securing Devices (active leaf) | <**Insert description.**> | <**Insert finish.**> |
| [#] | Operating Trim | <**Insert description.**> | <**Insert finish.**> |
| [#] | Accessories for Pairs of Doors | <**Insert description.**> | <**Insert finish.**> |
| [#] | Closing Devices | <**Insert description.**> | <**Insert finish.**> |

| | | | |
|---|---|---|---|
| [#] | Protective Trim Units | <**Insert description.**> | <**Insert finish.**> |
| [#] | Stops and Holders | <**Insert description.**> | <**Insert finish.**> |
| [#] | Accessories | <**Insert description.**> | <**Insert finish.**> |
| [#] | Miscellaneous Items | <**Insert description.**> | <**Insert finish.**> |

* Number of hinges, as specified.

END OF SECTION 08712

# SECTION 08 90 00
# LOUVERS AND VENTS

## PART 1 - GENERAL

### 1.1 DESCRIPTION

A. This section specifies fixed and operable wall louvers, door louvers and wall vents.

### 1.2 RELATED WORK

A. Section 08 11 13, HOLLOW METAL DOORS AND FRAMES: Louvers in Steel Doors.

B. Section 09 06 00, SCHEDULE FOR FINISHES: Color of finish.

C. Section 13 49 00, RADIATION PROTECTION: Louvers in lead lined wood doors.

### 1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings:

1. Each type, showing material, finish, size of members, // operating devices, // method of assembly, and installation and anchorage details.

C. Manufacturer's Literature and Data:

1. Each type of louver and vent.

D. Color samples.

E. Blast Design Calculations: Louver System and Anchorage

1. Submit calculations for review and approval prepared by qualified blast consultant, with a minimum of 5 years experience in design of blast resistant window systems, verifying louver assembly including anchors comply with specified blast resistance performance. The magnitudes of the design threats W1,W2 and GP1,GP2 are defined in the Physical Security Design Standards Data Definitions which is a document separate from the referenced VA Security Design Manual. The Physical Security Design Standards Data Definitions are provided on a need to know basis by the blast/structural engineer performing the blast design on VA projects. It is the responsibility of the engineer of blast resistant windows to request and obtain the Physical Security Design Data Standard Data Definitions from the VA Office of Construction and Facilities Management (CFM). Any

associated delays or increased costs due to failure to obtain this information will be borne by the contractor.

**1.4 APPLICABLE PUBLICATIONS:**

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. The Master Painters Institute (MPI):
Approved Product List – Updated Monthly

C. ASTM International (ASTM):

| | |
|---|---|
| A240/A240M-20 ..... | Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications |
| A653/A653M-20 ..... | Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dip Process |
| A1008/A1008M-20 ..... | Steel, Sheet, Carbon, Cold Rolled, Structural, and High Strength Low-Alloy with Improved Formability |
| B209-14 ..... | Aluminum and Aluminum Alloy, Sheet and Plate |
| B209M-14 ..... | Aluminum and Aluminum Alloy, Sheet and Plate (Metric) |
| B221-14 ..... | Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes |
| B221M-13 ..... | Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes (Metric) |
| D1187/D1187M-97(2018) .. | Asphalt-Base Emulsions for Use as Protective Coatings for Metal |

D. National Association of Architectural Metal Manufacturers (NAAMM):

| | |
|---|---|
| AMP 500-06 ..... | Metal Finishes Manual |

E. National Fire Protection Association (NFPA):

| | |
|---|---|
| 90A-15 ..... | Installation of Air Conditioning and Ventilating Systems |

F. American Architectural Manufacturers Association (AAMA):

| | |
|---|---|
| 2605-13 ..... | High Performance Organic Coatings on Architectural Extrusions and Panels |

G. Air Movement and Control Association, Inc. (AMCA):

| | |
|---|---|
| 500-L-07 | Testing Louvers |

H Department of Veterans Affairs:

//VA Physical Security Design Manual for Life Safety Protected Facilities January 2015//

// VA Physical Security Design Manual for Mission Critical Protected Facilities January 2015//

I. Protective Design Center

PDC-TR-08 Single Degree of Freedom Structural Response Limits for Antiterrorism Design

**PART 2 - PRODUCTS**

**2.1 MATERIALS:**

A. Aluminum, Extruded: ASTM B221M (B221).

B. Stainless Steel: ASTM A240/A240M, Type 302B.

C. Galvanized Steel Sheet: ASTM A653/A653M; G90 min.

D. Carbon Steel and Sheet: ASTM A1008/A1008M (interior use louvers only).

E. Aluminum, Plate and Sheet: ASTM B209M (B209); alloy 3003 or 5005 with temper as required for forming.

F. Fasteners: Fasteners for securing louvers and wall vents to adjoining construction, except as otherwise specified or indicated in construction documents, to be toggle or expansion bolts of size and type as required for each specific type of installation and service condition.

1. Where type, size, or spacing of fasteners is not shown or specified, submit shop drawings showing proposed fasteners, and method of installation.
2. Fasteners for louvers, louver frames, and wire guards to be of stainless steel or aluminum with same finish as louvers.
3. Fasteners for louvers, louver frames and wire guards within mental health areas to be non-removable/tamper-proof type.

G. Inorganic Zinc Primer: MPI No. 19.

H. Bituminous Coating: ASTM D1187/D1187M; cold applied asphalt mastic emulsion.

**2.2 EXTERIOR WALL LOUVERS:**

A. General:

1. Provide // fixed // // and operable // type louvers of size and design shown.
2. Heads, sills and jamb sections are to have formed caulking slots or be designed to retain caulking. Head sections are to have exterior drip lip, and sill sections an integral water stop.

3. Furnish louvers with sill extension or separate sill as shown.
4. Frame is to be mechanically fastened or welded construction with welds dressed smooth and flush.

B. Performance Characteristics:

1. Weather louvers are to have a minimum of //  // percent free area and to pass //  // mm/s (//  // fpm) free area velocity at a pressure drop not exceeding //  // mm (//  // inch) water gauge and carry not more than //  // g (//  // ounces) of water per square meter (//  // square foot) of free area for 15 minutes when tested per AMCA Standard 500-L.
2. Louvers are to bear AMCA certified rating seals for air performance and water penetration ratings.
3. Blast Resistance:
   A. Louvers in exterior walls shall be blast resistant and meet the following criteria per the VA Physical Security Design Manual for //Life Safety // //Mission Critical//Protected Facilities January 2015:
      1. Standoff Distance: //25 feet (Life Safety Protected) //50 feet (Mission Critical Protected)//
         a. Design Threat W1 at the standoff distance not to exceed pressure and impulse associated with //GP1 threat for Life Safety Protected Buildings// // W1 at the standoff distance not to exceed pressure and impulse associated with GP2 threat for Mission Critical Protected Buildings//.
         b. Deformation not to exceed those defined by B3 response per the Protective Design Center document PDC-TR-08 while experiencing design level pressures.

C. Aluminum Louvers:

1. General: Frames, blades, // sills // and mullions (sliding interlocking type); 2 mm (0.078-inch) thick extruded 6063-T5 or –T52 aluminum. Blades to be // standard // // drainable // type and have reinforcing bosses.
2. Louvers, fixed: Make frame sizes 13 mm (1/2-inch) smaller than openings. Single louvers frames are not to exceed 1676 mm (66 inches) wide. When openings exceed 1676 mm (66 inches), provide twin louvers separated by mullion members.

3. Louvers are to withstand the effects or gravity loads and the following wind loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors.
   a. Wind load acting inward or outward of not less than 1436 //_____// Pa (30 //_____// pound per square foot.).
4. Louvers, operable: Louver frame opening sizes, single louver sizes and mullion requirements are to be as specified for fixed louvers.
   a. Blades: Attach blades to frame with aluminum pivot pins through nylon bearings. Fasten each blade to stainless steel operation arms that are connected to minimum 3 mm (1/8-inch) thick stainless steel operating // bar // // handle // arranged for simultaneous operation of blades.
   b. //Spring/chain operation: Exposed operator activated by spring attached to operating // bar // // handle // and mounted on frame.// //Control of louver to be by pull chain of required length to be operable from floor. Provide pulleys and brackets as required.//
   c. //Hand crank operation: Hand crank operator activated by case hardened gears concealed in aluminum housing. Operators are to be removable and located at jambs. Provide one right-handed operator for each louver. //
   d. // Motor operation: Motor operated by approved electric motor. Motors are to be removable and located at jambs of louver. Connect motor operator lever arm to operating bar by means of stainless steel connecting rod. //
   e. // Automatic operation: Louvers are to be complete with // weights, // // pull chain, // // chain holder and brackets, // // cables, // // sheaves, // // spring, // // 70 degrees C (160 degrees F) fusible link, // and other related items meeting requirements of NFPA 90A. Provide non-ferrous bearings and spindles of replaceable type. // Control of louver to be by pull chain of required length to be operable from floor. // Louvers are to close automatically in case of fire. //

D. Stainless Steel Louvers: Form stainless steel louvers using 1.6 mm (0.063-inch) thick sheet for frames, blades, sills and mullions.

1. Provide louver with fixed 45 degree // standard // // drainable // blades with water baffle. Make overall frame size 13 mm (1/2-inch) less than opening, unless otherwise indicated in construction documents.
2. Single louver sections are not to exceed 1676 mm (66 inches) in width. For openings larger than 1676 mm (66 inches) wide, provide multiple sections not larger than 1676 mm (66 inches) wide separated by mullions.

E. Formed Steel Louvers: Form // galvanized // louvers using 1.5 mm (0.059-inch) thick sheet for frames, blades, sills and mullions.
1. Provide louver with fixed 45 degree // standard // // drainable // blades with water baffle. Make overall frame size 13 mm (1/2-inch) less than opening, unless otherwise indicated in construction documents.
2. Single louver sections are not to exceed 1676 mm (66 inches) in width. For openings larger than 1676 mm (66 inches) wide, provide multiple sections not larger than 1676 mm (66 inches) side separated by mullions.

**2.3 CLOSURE ANGLES AND CLOSURE PLATES:**

A. Fabricate from 2 mm (0.078-inch) thick stainless steel or aluminum.
B. Provide continuous closure angles and closure plates on inside head, jambs and sill of exterior wall louvers.
C. Secure angles and plates to louver frames with screws, and to masonry or concrete with fasteners as indicated in construction documents.

**2.4 WIRE GUARDS:**

A. Provide wire guards on outside of all exterior louvers, except on exhaust air louvers.
B. Fabricate frames from // 2 mm (0.078-inch) thick extruded or sheet aluminum // // 1.5 mm (0.059-inch) thick stainless steel // designed to retain wire mesh.
C. Wire mesh to be woven from not less than // 1.6 mm (0.063-inch) diameter aluminum wire // // 1.3 mm (0.05-inch) diameter stainless steel wire // in 13 mm (1/2-inch) square mesh.
D. Miter corners and join by concealed corner clips or locks extending not less than 57 mm (2-1/4 inches) into rails and stiles. Equip wire guards over 1219 mm (4 feet) in height with a mid-rail constructed as specified for frame components.

E. Fasten frames to outside of louvers with aluminum or stainless steel devices of same finish as louvers designed to allow removal and replacement without damage to the wire guard or the louver.

**2.5 BLANK-OFF PANELS:**

A. Uninsulated panels attached with clips or screws as follows: Panel finish is to be // same finish applied to louvers // // same finish type applied to louvers but black color //.

1. Aluminum sheet for aluminum louvers, 1.27 mm (0.050 inch) minimum thickness.
2. Galvanized-steel sheet for galvanized-steel louvers, 1.02 mm (0.040 inch) minimum.
3. Stainless-steel sheet for stainless-steel louvers, not less than 0.95 mm (0.038 inch) minimum.

B. Insulated laminated panels consisting of an insulating core surfaced on back and front with metal sheets and attached to back of louver with clips on screws and gasketed or sealant sealed perimeter. Panel finish is to be // same finish applied to louvers // //same type of finish applied to louvers but black color //.

1. Thickness: // 25 mm (1 inch) // // 50 mm (2 inches) // .
2. Aluminum sheet for aluminum louver 0.81 mm (0.032 inch) minimum.
3. Galvanized-steel sheet for galvanized-steel louver 0.71 mm (0.028 inch) minimum.
4. Stainless-steel sheet for stainless-steel louvers 0.79 mm (0.031 inch) minimum.
5. Insulating Core: // Rigid, glass-fiber-board insulation // // extruded-polystyrene foam //.

**2.6 EXTERIOR DOOR LOUVERS:**

A. Fabricate of 1.6 mm (0.063-inch) thick extruded aluminum. Miter frames at corners and join by concealed corner brackets. Louvers are to be weather resistant type.

B. Equip louvers on outside with wire guards, except omit wire guards for louvers in doors located completely below enclosed areaways.

**2.7 INTERIOR DOOR LOUVERS:**

A. Fabricate louvers for interior doors // and partitions of // // 1.2 mm (0.0472-inch) thick steel // // 1.6 mm (0.063-inch) thick extruded aluminum //.

B. Make louvers sight-proof type with stationary blades, // except where light-proof louvers are required //.

C. //Lightproof louvers are to have stationary blades and be designed to exclude passage of light but permit free ventilation. //

**2.8 WALL VENTS:**

A. Fabricate exterior wall vents from either 4.7 mm (0.185-inch) thick aluminum plate or 6 mm (1/4-inch) thick cast iron, perforated in diamond lattice pattern, with not over 19 mm (3/4-inch) openings.

B. Vents are to have aluminum screen frame with aluminum alloy insect screening mounted on back of vent by means of 19 mm x 5 mm (3/4-inch by 3/16-inch) top and bottom bars screwed to grille.

C. Vent Frames in Masonry: Fabricate of 45 mm x 30 mm x 5 mm (1-3/4 inch by 1-1/4 inch by 3/16-inch) steel angles bolted with 6 mm (1/4-inch) diameter expansion bolts at jambs.

**2.9 AIR INTAKE VENTS:**

A. Fabricate exterior louvered wall ventilators for fresh air intake for air conditioning units from extruded aluminum, ASTM B221M (B221). Form with integral horizontal louvers and frame, with drip extending beyond face of wall and integral water stops.

B. //Provide aluminum closures where shown for inside face of dummy vents.//

C. Provide 0.8 mm (0.032-inch) thick aluminum sleeves // in cavity walls // // where indicated in construction documents //.

**2.10 BRICK VENTS:**

A. Vents are to be of size shown formed of approximately 3 mm (0.125 inch) thick cast aluminum, or 3 mm (0.118 inch) extruded aluminum.

B. Provide vents complete with aluminum screen frame with corrosion resistant insect screening mounted on back of vent.

C. Provide vents with required anchors.

**2.11 FINISH:**

A. In accordance with NAAMM Metal Finishes Manual: AMP 500-505

B. Aluminum Louvers // Air Intake Vents // // Wire Guards // // Blank Off Panels //:

1. Anodized finish

a. //AA-M1X, Mill finish, as fabricated.//

b. //AA-M10C22A41, Chemically etched medium matte, with clear anodic coating, Class I Architectural, 0.17 mm (0.7 mils) thick.//

c. //AA-M10C22A42, Chemically etched medium matte, with integrally colored anodic coating, Class I Architectural, 0.17 mm (0.7 mils) thick.//

d. //AA-M10C22A44, Chemically etched medium matte, with electronically deposited metallic compound, Class I Architectural, 0.17 mm (0.7 mils) thick color anodic coating. Dyes will not be accepted.//

2. Organic Finish: AAMA 2605 (Fluorocarbon coating) with total dry film thickness of not less than 0.03 mm (1.2 mil), color as indicated in Section 09 06 00, SCHEDULE FOR FINISHES.

A. Aluminum // Wall Vents // // and Brick Vents //: Sand blasted satin finish.

B. Stainless Steel: Mechanical finish No. 4 in accordance with NAAMM Metal Finishes Manual.

C. Galvanized Sheet Steel: Two-coat baked-enamel or powder-coat finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 0.05 mm (2 mils).

1. Paint interior surfaces of lightproof louvers with two (2) additional finish shop coats of baked-on flat black enamel.

2. //Finish painting of exposed surfaces of shop primed louvers is specified in Section 09 91 00, PAINTING. //

3. //Manufacturer finished louvers // and blank-off panels // are to have color as indicated in Section 09 06 00, SCHEDULE FOR FINISHES. //

D. Steel: Surfaces of steel work, for which no other finish is specified, are to be cleaned free from scale, rust, oil and grease, and then given a light colored prime paint after fabrication, except ferrous metals concealed in finished work. Paint all contact surfaces of assembled work (except welded contact surfaces) with an additional shop coat of similar paint.

**2.12 PROTECTION:**

A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces of the dissimilar material with a heavy coat of bituminous coating (complete coverage), or by separating the contact surfaces with a performed synthetic rubber tape having pressure sensitive adhesive coating on one side.

B. Isolate the aluminum from plaster, concrete and masonry by coating aluminum with zinc-chromate primer.

C. Protect finished surfaces from damage during fabrication, erection, and after completion of the work. Strippable plastic coating on // colored anodized // // organic // finish is not approved.

**PART 3 - EXECUTION**

**3.1 INSTALLATION:**

A. Set work accurately, in alignment and where indicated in construction documents. Install plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.

B. Furnish setting drawings and instructions for installation of anchors and for the positioning of items having anchors to be built into masonry construction. Provide temporary bracing for such items until masonry is set.

C. Provide anchoring devices and fasteners as shown and as necessary for securing louvers // and vents // to building construction as specified. Power actuated drive pins may be used, except for removal items and where members would be deformed or substrate damaged by their use.

D. Set wall louvers // and vents // in masonry walls during progress of the work. If wall louvers // and vents // are not delivered to job in time for installation in prepared openings, make provision for later installation. Set in cast-in-place concrete in prepared openings.

**3.2 CLEANING AND ADJUSTING:**

A. After installation, all exposed prefinished and plated items and all items fabricated from stainless steel and aluminum are to be cleaned as recommended by the manufacturer and protected from damage until completion of the project.

B. All movable parts, including hardware, are to be cleaned and adjusted to operate as designed without binding or deformation of the members, so as to be centered in the opening of frame, and where applicable, to have all contact surfaces fit tight and even without forcing or warping the components.

C. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Contracting Officer Representative (COR) damaged units and replace with new units.

- - - E N D - - -

# Division 9 – Finishes

**SECTION 09180**
**CEMENT PLASTER**

## 1- RELATED DOCUMENTS

The general provisions of the contract including General and Special Conditions, apply to the work specified in this section.

## 2- DESCRIPTION OF WORK

The extent of the portland cement plaster work is shown on the drawings.

## 3. GENERAL

Delivery and Storage of Materials:

Except for sand and water, deliver materials to the site in sealed containers or bags fully identified with manufacturer's name, brand, type and grade. Store materials in a dry, well-ventilated space, under cover, off the ground and away from surfaces subject to dampness or condensation.

Warm Weather Requirements:

Protect plaster against uneven and excessive evaporation and from strong blasts of dry air, both natural or artificial. Apply and cure plaster as required by climatic and job conditions to prevent rapid dryout. Provide suitable coverings, moist curing, barriers to deflect sunlight and wind, or combinations of these, as required.

Ventilation Requirements:

Provide natural or mechanical means of ventilation to properly dry interior plaster during and after application.

Sample Installation:

Prior to installation of plaster work, plaster sample section of each type of plaster required for approval of the Arch. Demonstrate the proposed range of texture, workmanship, and color if required, to be expected in the complete work.

## 4. MATERIALS

Bonding Compound:

ASTM C 631 of FS MMM – B 350 or MIL Spec. – 19235.

For exterior use, provide bonding compound which is not affected by moisture on surface or present in plaster base and suitable for temperature conditions at application time.

Aggregate:

Natural or manufactured sand, complying with ASTM C 144, except grade within the following limits (expressed as the minimum and maximum percentage retained by weight on U.S. Standard Sieves, plus or minus 2%); No. 4 Sieve – 0%, No. 8 Sieve – 0 to 16%., No. 16 Sieve – 10 to 40%, No. 30 Sieve – 30 to 65%, No. 50 Sieve – 95 to 100%.

Portland Cement:

ASTM C 150, Type I color gray unless otherwise called for by the finish schedule.

## 5. INSTALLATION

General Requirements:

Contractor must examine all surfaces which are to receive plaster and all grounds and other accessories which act as grounds or screeds, and shall notify the Architect in writing, of any conditions detrimental to the proper and timely completion of the work. do not proceed with the plaster work until unsatisfactory conditions have been corrected in a manner acceptable to the Contractor.

Protect continuous work from rusting or soiling as a result of plastering operations.

Mix materials for a minimum of 2 minutes or until all ingredients present a uniform color in the mixer. Use the minimum amount of water required to produce plaster of a workable consistency. Use only clean water, fre from impurities which might impair the plaster work.

Hand apply plaster to the specified thickness. Machine application of plaster will not be allowed, except where sprayed-on plaster is specified.

Apply plaster to an entire wall or ceiling panel with interruptions occurring only at junctions of plaster planes or at openings or expansion and control joints (if any). Where the distance between such natural interruptions exceeds 20' in either direction, plaster application may be interrupted when the practical application limits is exceeded.

Where plaster abuts frames or other items of metal or wood which act as plaster ground, and plaster is not terminated by a casing bead, tool edge of plaster to produce a small uniform "V" joint.

Wherever a masonry wall abuts or adjoins the concrete framework, tool plaster to produce a "V" joint.

Plaster work shall be finished level, plumb, square, and true, within a tolerance of 1/8-inch in 10 feet, without waves, cracks, blisters, pits, crazing, discoloration, projections, or other imperfections. Plaster work shall be formed carefully around angles and contours, and well up to screeds. Special care shall be taken to prevent sagging. There shall be no visible junction marks in finish coat where one day's work adjoins another. Finished work shall be covered and protected in an approved manner to prevent damage.

Plaster Proportions: (By volume)

| | | |
|---|---|---|
| Sand | 5 3/4 | parts |
| Lime | 1 | parts |
| Cement | 1 1/3 | parts |

Hair or fiber may be used in the mix for the first (scratch) basecoat applied to metal lath. Do not use more than one pound of hair or fiber per bag of cementitious material. Use goat, cattle or deer hair or pure manilla fiber, ½" to 2" long, free from grease, oil, deer and other impurities.

Accurately measure ingredients, including water, using measuring devices of known volume. Do not use shovel or water buckets as measuring devices. Proportion successive batches alike.

Place coat within a maximum of 2-1/2 hours after mixing, except during hot, dry weather, reduce maximum placing time as required to prevent premature stiffening of plaster.

Plaster over Metal Lath:

Apply 3 – coat plaster over all metal lath, with or without solid backing. Apply first (scratch) coat not less than ½" thick and second (brown) basecoat not less than ¼" thick.

Measure thickness of plaster from back plane of metal lath (exclusive of ribs of dimples), except if metal lath is applied over solid base, measure from face of solid baking.

Apply first basecoat with sufficient material and pressure to form full keys through metal lath and to embed lath with sufficient plaster coverage. After first coat is firm, scratch (score) in one direction only, to provide mechanical bond for second coat. On vertical surfaces, scratch in horizontal direction.

Apply second basecoat with sufficient material and pressure to ensure tight contact with first basecoat. Bring surface to a true, even plane rodding and float to a uniformly rough surface. Fill defects and scratches with plaster.

After the second coat has been allowed to dry slowly for 24 hours, the finish coat shall be applied to a thickness of not less than 1/8" thick, with a sand float finish.

Plaster over Concrete or Masonry:

Surfaces shall be free of loose or deteriorated areas, clean and free of dust, loose particles, and foreign matter.

Apply bonding agent to concrete surfaces prior to application of plaster, in accordance with manufacturer's instructions.

Apply plaster in a single coat not less than 3/8" thick, rod to a true, smooth surface and float to an even sand finish.

Moisture Retention Requirements:

Dampen bases, if required, for proper suction. Do not saturate bases and do not apply plaster until visible surface water disappears.

Dampen previous plaster coats which have dried out prior to time for applications of next coat. Dampen with water as required for uniform suction.

The Contractor is responsible for determining the most effective procedure for curing and time lapse between applications of coats based on climatic and job conditions. Plaster which is cracked or crazed due to improper timing and curing will not be accepted. Remove and replace unacceptable plaster including plaster base materials, if damaged during removal of defective plaster.

## 6. CUTTING AND PATCHING

Cut, patch, repair, and point-up plaster as required and as directed by the Arch. Repair cracks and indented surfaces by moistening plaster and filling with new material, throweled or tamped flush with adjoining surfaces. Point-up finish plaster surfaces around items which are built into or penetrate plaster surfaces.

## 7. CLEANING AND PROTECTION

Make provisions to minimize spattering of plaster on other work. Promptly remove plaster from door frames, windows and other surfaces which are not to be plastered. Repair floors, walls and other surfaces which have been stained, marred or otherwise damaged during the plastering work. When plastering work is completed, remove unused materials, containers and equipment and clean floors of all plaster debris.

Contractor shall be aware of requirements for protection of plaster from deterioration and damage until time of acceptance of the work.

**END OF SECTION**

# SECTION 09671 - RESINOUS FLOORING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. This Section includes resinous flooring systems with [**epoxy**] [**epoxy-novolac**] [**urethane**] [**vinyl-ester**] <**Insert resin**> body coat(s).

1. Application Method: [**Self-leveling slurry with broadcast aggregates**] [**Self-leveling slurry**] [**Troweled or screeded**].

B. Related Sections include the following:

1. Division 1 Section "LEED Requirements" for additional LEED requirements.
2. Division 7 Section "Joint Sealants" for sealants installed at joints in resinous flooring systems.
3. Division 9 Section "Epoxy Terrazzo" for thin-set, resinous terrazzo.

### 1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.

B. Samples for Initial Selection: For each type of exposed finish required.

C. Samples for Verification: For each resinous flooring system required, 6 inches (150 mm) square, applied to a rigid backing by Installer for this Project.

D. LEED Submittals:

1. Credit EQ 4.1: Manufacturers' product data for installation adhesive, including printed statement of VOC content.

E. Product Schedule: Use resinous flooring designations indicated in Part 2 and room designations indicated on Drawings in product schedule.

F. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.

G. Material Test Reports: For each resinous flooring component.

H. Material Certificates: For each resinous flooring component, signed by manufacturer.

I. Maintenance Data: For resinous flooring to include in maintenance manuals.

## 1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer (applicator) who is experienced in applying resinous flooring systems similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance, and who is acceptable to resinous flooring manufacturer.

1. Engage an installer who employs only persons trained and approved by resinous flooring manufacturer for applying resinous flooring systems indicated.
2. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.

B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, through one source from a single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.

C. Federal Agency Approvals: Where indicated, provide resinous flooring systems approved by the [**USDA**] [**FDA**] for use indicated.

D. Mockups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Apply full-thickness mockups on 48-inch- (1200-mm-) square floor area selected by Architect.

   a. Include 48-inch (1200-mm) length of integral cove base.

2. Simulate finished lighting conditions for Architect's review of mockups.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

B. Store materials to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.

B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.

C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application, unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 RESINOUS FLOORING <**Insert drawing designation**>

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

B. Products: Subject to compliance with requirements, provide one of the following:

1. Arizona Polymer Flooring, Inc.; <**Insert product designation(s)**>.
2. Atlas Minerals & Chemicals, Inc., Polymer Flooring Division; <**Insert product designation(s)**>.
3. ChemMasters; <**Insert product designation(s)**>.
4. Crawford Laboratories, Inc.; <**Insert product designation(s)**>.
5. Crossfield Products Corp., Dex-O-Tex; <**Insert product designation(s)**>.
6. Dur-A-Flex Inc.; <**Insert product designation(s)**>.
7. General Polymers Corporation, a division of the Sherwin-Williams Company; <**Insert product designation(s)**>.
8. Key Resin Company; <**Insert product designation(s)**>.
9. Kinsman Corporation, Nox-Crete, Inc.; <**Insert product designation(s)**>.
10. Micor Company, Inc.; <**Insert product designation(s)**>.
11. Pacific Polymers, Inc.; <**Insert product designation(s)**>.
12. Palma, Inc.; <**Insert product designation(s)**>.
13. Polymerica Incorporated; <**Insert product designation(s)**>.
14. Protective Floorings & Linings, Inc.; <**Insert product designation(s)**>.
15. RBC Industries, Inc.; <**Insert product designation(s)**>.
16. Rust-Oleum Concrete Protection Systems, Inc.; <**Insert product designation(s)**>.
17. Seamco Laboratories, Inc.; <**Insert product designation(s)**>.
18. Selby-Ucrete Industrial Flooring, a division of Master Builders, Inc.; <**Insert product designation(s)**>.
19. Silikal Resin Systems; <**Insert product designation(s)**>.
20. Stonhard, Inc.; <**Insert product designation(s)**>.
21. Tamms Industries, Inc.; <**Insert product designation(s)**>.
22. Torginol, Inc.; <**Insert product designation(s)**>.
23. Ultradec, Inc.; <**Insert product designation(s)**>.
24. Valspar, Federal Flooring Division; <**Insert product designation(s)**>.
25. <**Insert manufacturer's name; product designations(s).**>

C. System Characteristics:

1. Color and Pattern: [**As selected by Architect from manufacturer's full range**] [**As indicated by product designation listed above**] [**Match Architect's sample**] <**Insert description**>.
2. Wearing Surface: [**Textured for slip resistance**] [**Manufacturer's standard orange-peel texture**] [**Smooth**] <**Insert description**>.
3. Integral Cove Base: [**4 inches (100 mm)**] <**Insert dimension**> high.
4. Overall System Thickness: [**1/16 inch (1.6 mm)**] [**1/8 inch (3.2 mm)**] [**3/16 inch (4.8 mm)**] [**1/4 inch (6.4 mm)**] <**Insert thickness**>.
5. Federal Agency Approvals: [**USDA**] [**FDA**] approved for food-processing environments.

D. System Components: Manufacturer's standard components that are compatible with each other and as follows:

1. Body Coat(s):

   a. Resin: [**Epoxy**] [**Epoxy novolac**] [**Urethane**] [**Vinyl ester**] <**Insert resin**>.
   b. Formulation Description: [**100 percent solids**] [**High solids**] [**Water based**] <**Insert requirements**>.
   c. Application Method: [**Self-leveling slurry with broadcast aggregates**] [**Self-leveling slurry**] [**Troweled or screeded**].

      1) Thickness of Coats: [**1/16 inch (1.6 mm)**] [**1/8 inch (3.2 mm)**] [**3/16 inch (4.8 mm)**] [**1/4 inch (6.4 mm)**] <**Insert dimension**>.
      2) Number of Coats: [**One**] [**Two**].

   d. Aggregates: [**Manufacturer's standard**] [**Colored quartz (ceramic-coated silica)**] [**Vinyl flakes**] [**Granite**] [**Natural silica**] <**Insert requirements**>.

2. Primer: Type recommended by manufacturer for substrate and body coat(s) indicated.

   a. Formulation Description: [**100 percent solids**] [**High solids**] [**Water based**] <**Insert requirements**>.

3. Waterproofing Membrane: Type recommended by manufacturer for substrate and primer and body coat(s) indicated.

   a. Formulation Description: [**100 percent solids**] [**High solids**] <**Insert requirements**>.

4. Reinforcing Membrane: Flexible resin formulation that is recommended by manufacturer for substrate and primer and body coat(s) indicated and that prevents substrate cracks from reflecting through resinous flooring.

   a. Formulation Description: [**100 percent solids**] [**High solids**] <**Insert requirements**>.
   b. Provide fiberglass scrim embedded in reinforcing membrane.

5. Topcoat: [**Chemical-resistant**] [**UV-resistant**] <**Insert requirements**> sealing or finish coat(s).

a. Resin: [**Epoxy**] [**Epoxy novolac**] [**Urethane**] [**Vinyl ester**] <**Insert resin**>.
b. Formulation Description: [**100 percent solids**] [**High solids**] [**Water based**] <**Insert requirements**>.
c. Type: [**Clear**] [**Pigmented**] <**Insert description**>.
d. Finish: [**Matte**] [**Gloss**].
e. Number of Coats: [**One**] [**Two**].

E. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:

1. Compressive Strength: <**Insert value**> per ASTM C 579.
2. Tensile Strength: <**Insert value**> per ASTM C 307.
3. Flexural Modulus of Elasticity: <**Insert value**> per ASTM C 580.
4. Water Absorption: <**Insert value**> per ASTM C 413.
5. Coefficient of Thermal Expansion: <**Insert value**> per ASTM C 531.
6. Indentation: <**Insert value**> percent maximum per MIL-D-3134.
7. Impact Resistance: No chipping, cracking, or delamination and not more than 1/16-inch (1.6-mm) permanent indentation per MIL-D-3134.
8. Resistance to Elevated Temperature: No slip or flow of more than 1/16 inch (1.6 mm) per MIL-D-3134.
9. Abrasion Resistance: <**Insert value**> maximum weight loss per ASTM D 4060.
10. Flammability: Self-extinguishing per ASTM D 635.
11. Hardness: <**Insert value**>, Shore D per ASTM D 2240.
12. Bond Strength: <**Insert value**>, 100 percent concrete failure per ACI 503R.

F. System Chemical Resistance: Test specimens of cured resinous flooring system are unaffected when tested according to [**ASTM D 543, Procedure A, for immersion**] [**ASTM C 267 for immersion**] [**ASTM D 1308 for 50 percent immersion**] <**Insert testing requirements**> in the following reagents for not less than 7 days:

1. <**Insert list of reagents that Owner has determined are likely to contact resinous flooring during in-service use.**>

## 2.2 ACCESSORY MATERIALS

A. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

B. Joint Sealant: Type recommended or produced by resinous flooring manufacturer for type of service and joint condition indicated.

1. Use sealants that have a VOC content of [**250**] <**Insert limit**> g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 PREPARATION

A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry, and neutral Ph substrate for resinous flooring application.

B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.

1. Roughen concrete substrates as follows:

a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
b. Comply with ASTM C 811 requirements, unless manufacturer's written instructions are more stringent.

2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written recommendations.
3. Verify that concrete substrates are dry.

a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application only after substrates have maximum moisture-vapor-emission rate of [**3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) of slab**] <**Insert emission rate**> in 24 hours.
b. Perform plastic sheet test, ASTM D 4263. Proceed with application only after testing indicates absence of moisture in substrates.
c. Perform additional moisture tests recommended by manufacturer. Proceed with application only after substrates pass testing.

4. Verify that concrete substrates have neutral Ph and that resinous flooring will adhere to them. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.

C. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

D. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

E. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written recommendations.

## 3.2 APPLICATION

A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.

1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
3. At substrate expansion and isolation joints, provide joint in resinous flooring to comply with resinous flooring manufacturer's written recommendations.

a. Apply joint sealant to comply with manufacturer's written recommendations.

B. Apply primer over prepared substrate at manufacturer's recommended spreading rate.

C. Apply waterproofing membrane, where indicated, in manufacturer's recommended thickness.

1. Apply waterproofing membrane to integral cove base substrates.

D. Apply reinforcing membrane to [**substrate cracks**] [**entire substrate surface**].

E. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.

F. Apply self-leveling slurry body coat(s) in thickness indicated for flooring system.

1. Broadcast aggregates and, after resin is cured, remove excess aggregates to provide surface texture indicated.

G. Apply troweled or screeded body coat(s) in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When cured, sand to remove trowel marks and roughness.

H. Apply grout coat, of type recommended by resinous flooring manufacturer to fill voids in surface of final body coat and to produce wearing surface indicated.

I. Apply topcoat(s) in number of coats indicated for flooring system and at spreading rates recommended in writing by manufacturer.

## 3.3 FIELD QUALITY CONTROL

A. Core Sampling: At the direction of Owner and at locations designated by Owner, take 1 core sample per 1000 sq. ft. (92.9 sq. m) of resinous flooring, or portion of, to verify thickness. For each sample that fails to comply with requirements, take two additional samples. Repair damage caused by coring and correct deficiencies.

B. Material Sampling: Owner may at any time and any number of times during resinous flooring application require material samples for testing for compliance with requirements.

1. Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
3. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.

## 3.4 CLEANING AND PROTECTING

A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION 09671

# SECTION 09900
# PAINTING

## 1. RELATED DOCUMENTS

The general provisions of the contract, including General and Special Conditions apply to the work specified in this section.

## 2. DESCRIPTION OF WORK

The extent of painting work is shown on the drawings and schedules, and as herein specified.

This work includes the painting and finishing of all interior and exterior exposed items and surfaces throughout the project, except as herein specified. Surface preparation, priming and coats of paint specified are in addition to shop priming and surface treatment specified under other sections, except as otherwise specified.

The work includes the field painting of all bare and covered pipes (including color coding), and of hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under the mechanical and electrical work, except as otherwise specified.

The "paint" as used herein means all coating systems materials which includes primers, emulsions, enamels, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

Paint all exposed surfaces whether or not colors are designated in any "schedule", except where the natural finish of the material is obviously intended and specifically noted as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint these same as adjacent similar materials or areas. If color or finish is not designated, the Architect will select these from standard colors available.

## 3. PAINTING NOT INCLUDED

The following categories of work are not included as part of the painter-applied finish work, or are included in other sections of these specifications, unless otherwise shown or specified.

Shop Priming

Unless otherwise specified, shop priming of ferrous metal-items is included under the various sections for structural steel, miscellaneous metal items, hollow metal work, and similar items. Also, for such fabricated components as architectural woodwork, wood casework, and shop fabricated or factory built mechanical and electrical equipment or accessories.

Pre-Finished Items

Unless otherwise indicated, do not include painting when factory finishing is specified for such items as (but not limited to) metal toilet enclosures, acoustic materials, architectural woodwork and casework, finished mechanical and electrical equipment including light fixtures, switchgear and distribution cabinets, doors and equipment.

Concealed Surfaces

Unless otherwise indicated, painting is not required on wall or ceiling surfaces in concealed areas and inaccessible areas, such as foundation spaces, furred areas, pipe spaces, duct shafts as applicable to this project.

Do not paint copper pipe, zinc-coated pipe and zinc-coated ducts under insulation. Do not paint zinc-coated and copper pipe in concealed spaces.

Finished Metal Surfaces

Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting, except as otherwise specified.

Operating Parts and Labels

Do not paint any moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts, unless otherwise indicated.

Do not paint over any code-required labels, such as Underwriters Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

## 4. GENERAL

Site Conditions

Starting of painting work will be construed as the Applicator's acceptance of the surfaces within any particular area.

Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to the formation of a durable paint film.

Atmospheric Conditions

Exterior paint shall not be applied when the temperature of the surface is below 45 degrees Fahrenheit or above 95 degrees Fahrenheit unless otherwise directed. Interior paint may be applied at any time, provided the surfaces to be painted are dry and the temperature can be kept above 45 degrees Fahrenheit during the application of ordinary paints, and between 65 degrees Fahrenheit and 95 degrees Fahrenheit during the application of enamels and varnishes. Paint shall not be applied during foggy or rainy weather or when, in the opinion of the A/E the surfaces are not in proper condition for painting.

Delivery and Storage

Deliver all materials to the job site in original, new and unopened packages and containers bearing manufacturer's name and label, and application instructions thereon.

Protection

Protect work of other trades, whether to be painted or not, against damage by the painting and finishing work. Leave nil such work undamaged. Correct any damages by cleaning, repainting or replacing, and repainting, as directed by the A/E.

Provide “Wet Paint" signs as required to protect newly painted finishes. Remove temporary protective wrappings after completion of painting operations.

Clean Up

During the progress of the work, remove from the project all discarded paint materials, rubbish, cans and rags.

Upon completion of painting work, clean all paint spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

Colors

Prior to beginning work, the A/E will furnish a color schedule to the Contractor.

## 5- MATERIALS

In the following schedule, refer to "Guide to U.S. Government Paint Specifications", Federal Standards & Test Methods, (19th. Edition) for type and quality of finishes required. Best grade products of manufacturers may be used only when copy of the test made by an independent laboratory are submitted by the Contractor and approved by the A/E.

FEDERAL STANDARDS & TEST METHODS:

Exterior concrete and masonry ..... TT-P-19c

Interior concrete and masonry ..... TT-P-29J

Water repellent, colorless, silicone base ..... SS-W-110C

Interior semi-gloss enamel ..... TT-P-102E

Interior Wood Stain ..... TT-S-711

Varnish, low sheen ..... TT-V-85c

Primer for aluminum and galvanized metal surfaces …… TT-P-641G

Primer for ferrous metal surfaces ..... TT-P-636D

Gloss enamel for metal surfaces ..... TT-E-489G

Wainscot epoxy coating ..... TT-C-535B

Linseed oil, turpentine, putty, ect ..... Best quality obtainable.

## 6- MATERIAL TESTING

The right is reserved by the A/E to engage the services of a testing laboratory to perform all the necessary tests to verify that the paint submitted for approval by the Contractor complies with the requirements of these specifications.

## 7- SURFACE PREPARATION

General

Perform all preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified.

Remove all hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish painted, or provide stir face-applied protection prior to surface preparation and painting operations. Remove, if necessary, for the complete painting of the items and adjacent surfaces. Following completion of painting of each space or area, reinstall the removed items by workmen skilled in the trades involved.

Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease with clean cloths and cleaning solvents prior to mechanical cleaning. Provide cleaning solvents of low toxicity and a flash point in excess of 100°F. Program the cleaning and painting so that dust and other contaminants from the cleaning process will not fall in wet, newly painted surfaces.

Cementitious Materials

Prepare cementitious surfaces of concrete, concrete block, cement plaster and cement-asbestos board to be painted by removing all efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze.

Determine the alkalinity and moisture content of the surfaces to be painted by performing appropriate tests. If the surfaces are found to be sufficiently alkaline to cause blistering and burning of the finish paint, correct this condition by sponging the affected surfaces with a zinc sulphate solution of 2 lbs. zinc sulphate per gal. of water, or other acceptable method, before application of paint. Do not paint over surfaces where the moisture content exceeds 8%, unless otherwise permitted in the manufacturer's printed directions.

Wood

Clean wood surfaces to be painted of all dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view, and dust off.

Prime, stain, or seal wood required to be job painted immediately upon delivery to job. Prime edges, ends, face, undersides, and backsides of such wood, including cabinets, counters, cases, paneling, etc. Seal tops and bottoms of wood doors with a heavy coat of varnish or equivalent sealer immediately upon delivery to job.

Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other approved sealer, before application of the priming coat.

After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sandpaper smooth when dried.

Ferrous Metals

Clean non-galvanized, ferrous surfaces that have not been shop-coated of all oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning, complying with SSPC recommendations.

Touch-up all shop-applied prime coats which have damaged, or bare areas, where required by other sections of these specifications. Wirebrush, solvent clean, and touch up with the same primer as the shop coat.

## 8- MATERIALS PREPARATION

Mix and prepare painting materials in strict accordance with the manufacturer's directions.

Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing, and application of paint in a clean condition, free of foreign materials and residue.

Stir all materials before application to produce a mixture of uniform density, and as required during the application of the materials. Do not stir any film which may form on the surfaces of materials into the material. Remove the film and, if necessary, strain the material before using.

## 9- APPLICATION

Apply paint by brush, roller or spray in accordance with the manufacturer's directions. Spray paint uniformly with suitable equipment.

The number of coats and paint film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat hag completely dried.

Apply additional coats when undercoats, stains, or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance.

"Exposed surfaces" shall mean areas visible when permanent of built in fixtures, grilles, etc., are in place in areas scheduled to be painted.

Paint the back sides of access panels, removable or hinged covers to match the exposed surfaces.

Finish exterior doors on tops, bottoms, and side edges the same as the exterior faces, unless otherwise indicated.

Sand lightly between each succeeding enamel or varnish coat.

Prime Coats

Before application of finish coats, apply a prime coat to material which is required to be painted or finished, and which has not been prime coated by others.

Recoat primed and sealed walls and ceilings where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn through or other defects due to insufficient sealing.

Mechanical Applications

Apply each roller coat to provide the equivalent hiding as brush-applied coats.

Use spray application (generally) on wire mesh and similar surfaces where hand brush work would be inferior.

Wherever spray application is used, apply each coat to provide the equivalent hiding of brush-app1ied coats. Do not double1back with spray equipment for the purpose of building up film thickness of 2 coats in one pass.

Completed Work

Match approved samples for color, texture and coverage. Remove, finish, or repaint work not in compliance with specified requirements.

## 10- SUBMITTALS

Manufacturer's Data

Submit 2 copies of manufacturer's specifications, including paint label analysis and application instructions for each material specified.

List each material and cross reference to the specific paint and finish system and application. Identify by manufacturer's catalog number and general classification. No painting work shall be done until this schedule has been finally approved.

Samples

On 12" x 12" hardboard, provide 2 samples of each color and material, with texture to simulate actual conditions. Resubmit each sample as requested until required sheen, color, and texture is achieved.

On actual wood surfaces, provide 2, 4" x 8" samples of each finish as required. Label and identify each as to location and application.

## 11- SURFACES TO BE PAINTED

The exact locations and limits of the surfaces requiring the various types of finishes shall be as established in the Color Schedule. The paint required for the various types of surfaces shall be as follows:

Exterior concrete, masonry or plastered surfaces, except as otherwise noted

Two (2) coats exterior concrete and masonry paint

Exterior exposed concrete surfaces, except as otherwise noted

Two (2) coats of water repellent finish

Interior concrete, masonry or plastered surfaces, except where indicated to receive an enamel finish

Two (2) coats interior concrete and masonry paint

Interior concrete, masonry or plastered surfaces indicated to received enamel finish

First coat - enamel undercoater as recommended by manufacturer

Second and third coats - Semi-gloss enamel

Interior woodwork (enamel finish)

First coat - enamel undercoater as recommended by the manufacturer

Second and third coats - Semi-gloss enamel

Interior woodwork (natural finish)

First coat - Stain if required

Second coat - Filler tinted to match stain if required by species of wood

Third and fourth coats - Semi-gloss varnish

Miscellaneous metal items which are specified under other sections to receive finishes as specified under this section or for which finishes are not specified under other sections

First coat - shop primed; or (1) coat of primer for galvanized or non-galvanized metal as the case may be

Second and third coats - gloss enamel

Wainscots indicated to receive polyurethane finish

Two (2) coats polyurethane paint

**END OF SECTION**

SECTION 09912 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes surface preparation and the application of paint systems on the following interior substrates:

1. Concrete.
2. Clay masonry.
3. Concrete masonry units (CMU).
4. Steel.
5. Galvanized metal.
6. Aluminum (not anodized or otherwise coated).
7. Wood.
8. Gypsum board.
9. Plaster.
10. Spray-textured ceilings.
11. Cotton or canvas insulation covering.

B. Related Sections include the following:

1. Division 1 Section "LEED Requirements" for additional LEED requirements.
2. Division 5 Sections for shop priming of metal substrates with primers specified in this Section.
3. Division 6 Sections for shop priming carpentry with primers specified in this Section.
4. Division 8 Sections for factory priming windows and doors with primers specified in this Section.
5. Division 9 Section "Exterior Painting" for surface preparation and the application of paint systems on exterior substrates.
6. Division 9 Section "Wood Stains and Transparent Finishes" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.
7. Division 9 painting Sections for special-use coatings.

1.3 SUBMITTALS

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

B. Samples for Initial Selection: For each type of topcoat product indicated.

C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat indicated.

1. Submit Samples on rigid backing, 8 inches (200 mm) square.
2. Step coats on Samples to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

D. Product List: For each product indicated, include the following:

1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.
2. Printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

E. LEED Submittals: For Credit EQ 4.2, manufacturers' product data for paints, including printed statement of VOC content and chemical components.

## 1.4 QUALITY ASSURANCE

A. MPI Standards:

1. Products: Complying with MPI standards indicated and listed in "MPI Approved Products List."
2. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

B. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.

a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).
b. Other Items: Architect will designate items or areas required.

2. Apply benchmark samples after permanent lighting and other environmental services have been activated.
3. Final approval of color selections will be based on benchmark samples.

a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.

## 1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.

2. Remove rags and waste from storage areas daily.

1.6 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that are from same production run (batch mix) as materials applied and that are packaged for storage and identified with labels describing contents.

1. Quantity: Furnish an additional [**5**] <**Insert number**> percent, but not less than [**1 gal. (3.8 L)**] <**Insert number**> of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Benjamin Moore & Co.
2. Benjamin Moore & Co., Limited (Canada).
3. Bennette Paint Mfg. Co., Inc.
4. BLP Mobile Paint Manufacturing.
5. California Paints.
6. ChemRex.
7. Cloverdale Paint.
8. Color Wheel Paints & Coatings.
9. Columbia Paint & Coatings.
10. Coronado Paint.
11. Davis Paint Company.
12. Diamond Vogel Paints.
13. Dunn-Edwards Corporation.
14. Durant Paints Inc.
15. Duron, Inc.
16. Envirocoat Technologies Inc.
17. Farrell-Calhoun.
18. Flex Bon Paints.

19. Frazee Paint.
20. General Paint.
21. Griggs Paint.
22. Hallman Lindsay Quality Paints.
23. Hirshfield's, Inc.
24. ICI Devoe (Canada).
25. ICI Paints.
26. ICI Paints (Canada).
27. Insl-x.
28. Iowa Paint Manufacturing Company, Inc.
29. Kelly-Moore Paints.
30. Kryton Canada Corporation.
31. Kwal-Howells Paint.
32. M.A.B. Paints.
33. McCormick Paints.
34. Miller Paint.
35. Mills Paint.
36. Northern Paint.
37. PARA Paints.
38. Parker Paint Mfg. Co. Inc.
39. Porter Paints.
40. PPG Architectural Finishes, Inc.
41. Rodda Paint Co.
42. Sherwin-Williams Company (The).
43. Sico, Inc.
44. Sigma Coatings.
45. Smiland Paint Company.
46. Spectra-Tone.
47. Sterling Paint.
48. Tamms Industries, Inc.
49. Tower Paint.
50. Vista Paint.
51. <**Insert manufacturer's name.**>

## 2.2 PAINT, GENERAL

A. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

B. Chemical Components of Field-Applied Interior Paints and Coatings: Provide products that comply with the following limits for VOC content, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24) and the following chemical restrictions; these requirements do not apply to primers or finishes that are applied in a fabrication or finishing shop:

1. Flat Paints and Coatings: VOC content of not more than 50 g/L.
2. Nonflat Paints and Coatings: VOC content of not more than 150 g/L.
3. Aromatic Compounds: Paints and coatings shall not contain more than 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
4. Restricted Components: Paints and coatings shall not contain any of the following:

    a. Acrolein.
    b. Acrylonitrile.
    c. Antimony.
    d. Benzene.
    e. Butyl benzyl phthalate.
    f. Cadmium.
    g. Di (2-ethylhexyl) phthalate.
    h. Di-n-butyl phthalate.
    i. Di-n-octyl phthalate.
    j. 1,2-dichlorobenzene.
    k. Diethyl phthalate.
    l. Dimethyl phthalate.
    m. Ethylbenzene.
    n. Formaldehyde.
    o. Hexavalent chromium.
    p. Isophorone.
    q. Lead.
    r. Mercury.
    s. Methyl ethyl ketone.
    t. Methyl isobutyl ketone.
    u. Methylene chloride.
    v. Naphthalene.
    w. Toluene (methylbenzene).
    x. 1,1,1-trichloroethane.
    y. Vinyl chloride.

C. Colors: [**As selected by Architect from manufacturer's full range**] [**Match Architect's samples**] [**As indicated in a color schedule**] <**Insert requirements**>.

## 2.3 BLOCK FILLERS

A. Interior/Exterior Latex Block Filler: MPI #4.

1. VOC Content: E Range of [**E2**] [**E3**].

## 2.4 PRIMERS/SEALERS

A. Interior Latex Primer/Sealer: MPI #50.

1. VOC Content: E Range of [**E1**] [**E2**] [**E3**].
2. Environmental Performance Rating: [**EPR 1**] [**EPR 2**] [**EPR 3**].

B. Interior Alkyd Primer/Sealer: MPI #45.

1. VOC Content: E Range of [**E1**] [**E2**].

C. Wood-Knot Sealer: Sealer recommended in writing by topcoat manufacturer for use in paint systems indicated.

## 2.5 METAL PRIMERS

A. Alkyd Anticorrosive Metal Primer: MPI #79.

1. VOC Content: E Range of [**E1**] [**E2**].

B. Quick-Drying Alkyd Metal Primer: MPI #76.

1. VOC Content: E Range of [**E1**] [**E2**] [**E3**].

C. Rust-Inhibitive Primer (Water Based): MPI #107.

1. VOC Content: E Range of [**E1**] [**E2**] [**E3**].
2. Environmental Performance Rating: [**EPR 1**] [**EPR 2**] [**EPR 3**].

D. Cementitious Galvanized-Metal Primer: MPI #26.

1. VOC Content: E Range of E1.

E. Waterborne Galvanized-Metal Primer: MPI #134.

1. VOC Content: E Range of [**E1**] [**E2**] [**E3**].
2. Environmental Performance Rating: [**EPR 1**] [**EPR 2**] [**EPR 3**].

F. Vinyl Wash Primer: MPI #80.

1. VOC Content: E Range of [**E2**] [**E3**].

G. Quick-Drying Primer for Aluminum: MPI #95.

1. VOC Content: E Range of [**E1**] [**E2**] [**E3**].

## 2.6 WOOD PRIMERS

A. Interior Latex-Based Wood Primer: MPI #39.

1. VOC Content: E Range of [**E1**] [**E2**] [**E3**].
2. Environmental Performance Rating: [**EPR 1**] [**EPR 2**] [**EPR 3**].

## 2.7 LATEX PAINTS

A. Interior Latex (Flat): MPI #53 (Gloss Level 1).

1. VOC Content: E Range of [**E1**] [**E2**] [**E3**].
2. Environmental Performance Rating: [**EPR 0.5**] [**EPR 1.5**] [**EPR 2.5**].

B. Interior Latex (Low Sheen): MPI #44 (Gloss Level 2).

1. VOC Content: E Range of [**E1**] [**E2**] [**E3**].
2. Environmental Performance Rating: [**EPR 1**] [**EPR 2**] [**EPR 3**].

C. Interior Latex (Eggshell): MPI #52 (Gloss Level 3).

1. VOC Content: E Range of [**E1**] [**E2**] [**E3**].
2. Environmental Performance Rating: [**EPR 1**] [**EPR 2**] [**EPR 3**].

D. Interior Latex (Satin): MPI #43 (Gloss Level 4).

1. VOC Content: E Range of [**E1**] [**E2**] [**E3**].
2. Environmental Performance Rating: [**EPR 1.5**] [**EPR 2**] [**EPR 2.5**] [**EPR 3.5**].

E. Interior Latex (Semigloss): MPI #54 (Gloss Level 5).

1. VOC Content: E Range of [**E1**] [**E2**] [**E3**].
2. Environmental Performance Rating: [**EPR 2**] [**EPR 3**] [**EPR 4**].

F. Interior Latex (Gloss): MPI #114 (Gloss Level 6, except minimum gloss of 65 units at 60 deg).

1. VOC Content: E Range of [**E1**] [**E2**] [**E3**].
2. Environmental Performance Rating: [**EPR 2**] [**EPR 3**] [**EPR 4**].

G. Institutional Low-Odor/VOC Latex (Flat): MPI #143 (Gloss Level 1).

1. VOC Content: E Range of E3.
2. Environmental Performance Rating: [**EPR 4**] [**EPR 5.5**].

H. Institutional Low-Odor/VOC Latex (Low Sheen): MPI #144 (Gloss Level 2).

1. VOC Content: E Range of E3.
2. Environmental Performance Rating: EPR 4.5.

I. Institutional Low-Odor/VOC Latex (Eggshell): MPI #145 (Gloss Level 3).

1. VOC Content: E Range of E3.
2. Environmental Performance Rating: EPR 4.5.

J. Institutional Low-Odor/VOC Latex (Semigloss): MPI #147 (Gloss Level 5).

1. VOC Content: E Range of E3.
2. Environmental Performance Rating: [**EPR 3**] [**EPR 5.5**].

K. High-Performance Architectural Latex (Low Sheen): MPI #138 (Gloss Level 2).

1. VOC Content: E Range of [**E1**] [**E2**] [**E3**].
2. Environmental Performance Rating: [**EPR 4**] [**EPR 5**] [**EPR 6**].

L. High-Performance Architectural Latex (Eggshell): MPI #139 (Gloss Level 3).

1. VOC Content: E Range of [**E2**] [**E3**].
2. Environmental Performance Rating: [**EPR 5**] [**EPR 6**].

M. High-Performance Architectural Latex (Satin): MPI #140 (Gloss Level 4).

1. VOC Content: E Range of [**E1**] [**E3**].
2. Environmental Performance Rating: [**EPR 4.5**] [**EPR 6.5**].

N. High-Performance Architectural Latex (Semigloss): MPI #141 (Gloss Level 5).

1. VOC Content: E Range of [**E1**] [**E2**] [**E3**].
2. Environmental Performance Rating: [**EPR 5**] [**EPR 6**] [**EPR 7**].

O. Exterior Latex (Flat): MPI #10 (Gloss Level 1).

1. VOC Content: E Range of [**E1**] [**E2**] [**E3**].

P. Exterior Latex (Semigloss): MPI #11 (Gloss Level 5).

1. VOC Content: E Range of [**E1**] [**E2**] [**E3**].

Q. Exterior Latex (Gloss): MPI #119 (Gloss Level 6, except minimum gloss of 65 units at 60 deg).

1. VOC Content: E Range of [**E1**] [**E2**] [**E3**].

## 2.8 ALKYD PAINTS

A. Interior Alkyd (Flat): MPI #49 (Gloss Level 1).

1. VOC Content: E Range of [**E1**] [**E2**] [**E3**].

B. Interior Alkyd (Eggshell): MPI #51 (Gloss Level 3).

1. VOC Content: E Range of [**E1**] [**E2**].

C. Interior Alkyd (Semigloss): MPI #47 (Gloss Level 5).

1. VOC Content: E Range of [**E1**] [**E2**].
2. Environmental Performance Rating: [**EPR 1**] [**EPR 2**] [**EPR 3**].

D. Interior Alkyd (Gloss): MPI #48 (Gloss Level 6).

1. VOC Content: E Range of [**E1**] [**E2**].

## 2.9 QUICK-DRYING ENAMELS

A. Quick-Drying Enamel (Semigloss): MPI #81 (Gloss Level 5).

1. VOC Content: E Range of [**E1**] [**E2**] [**E3**].

B. Quick-Drying Enamel (High Gloss): MPI #96 (Gloss Level 7).

1. VOC Content: E Range of [**E1**] [**E2**] [**E3**].

2.10 TEXTURED COATING

A. Latex Stucco and Masonry Textured Coating: MPI #42.

1. VOC Content: E Range of [**E2**] [**E3**].

2.11 DRY FOG/FALL COATINGS

A. Latex Dry Fog/Fall: MPI #118.

1. VOC Content: E Range of [**E1**] [**E2**] [**E3**].
2. Environmental Performance Rating: [**EPR 1**] [**EPR 2**] [**EPR 3**].

B. Waterborne Dry Fall: MPI #133.

1. VOC Content: E Range of [**E1**] [**E2**] [**E3**].
2. Environmental Performance Rating: [**EPR 1**] [**EPR 2**] [**EPR 3**].

C. Interior Alkyd Dry Fog/Fall: MPI #55.

1. VOC Content: E Range of [**E1**] [**E2**] [**E3**].

2.12 ALUMINUM PAINT

A. Aluminum Paint: MPI #1.

1. VOC Content: E Range of [**E1**] [**E2**] [**E3**].

2.13 FLOOR COATINGS

A. Interior Concrete Floor Stain: MPI #58.

1. VOC Content: E Range of [**E1**] [**E2**] [**E3**].
2. Environmental Performance Rating: EPR 2.

B. Interior/Exterior Clear Concrete Floor Sealer (Water Based): MPI #99.

1. VOC Content: E Range of [**E1**] [**E2**] [**E3**].

C. Interior/Exterior Clear Concrete Floor Sealer (Solvent Based): MPI #104.

1. VOC Content: E Range of [**E1**] [**E2**].

D. Interior/Exterior Latex Floor and Porch Paint (Low Gloss): MPI #60 (maximum Gloss Level 3).

1. VOC Content: E Range of [**E2**] [**E3**].
2. Environmental Performance Rating: EPR 3.

E. Exterior/Interior Alkyd Floor Enamel (Gloss): MPI #27 (Gloss Level 6).

1. VOC Content: E Range of [**E1**] [**E2**].
2. Additives: Manufacturer's standard additive to increase skid resistance of painted surface.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and CMU): 12 percent.
3. Wood: 15 percent.
4. Gypsum Board: 12 percent.
5. Plaster: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

### 3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Clay Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content of surfaces or alkalinity of mortar joints to be painted exceed that permitted in manufacturer's written instructions.

F. Concrete Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

G. Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.

H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

I. Aluminum Substrates: Remove surface oxidation.

J. Wood Substrates:

1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
2. Sand surfaces that will be exposed to view, and dust off.
3. Prime edges, ends, faces, undersides, and backsides of wood.
4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.

K. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

L. Plaster Substrates: Do not begin paint application until plaster is fully cured and dry.

M. Spray-Textured Ceiling Substrates: Do not begin paint application until surfaces are dry.

N. Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

## 3.3 APPLICATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Mechanical and Electrical Work: Paint items exposed in equipment rooms and occupied spaces including, but not limited to, the following:

1. Mechanical Work:

a. Uninsulated metal piping.
b. Uninsulated plastic piping.
c. Pipe hangers and supports.
d. Tanks that do not have factory-applied final finishes.
e. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
g. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
h. <**Insert mechanical items to be painted.**>

2. Electrical Work:

a. Switchgear.
b. Panelboards.
c. Electrical equipment that is indicated to have a factory-primed finish for field painting.
d. <**Insert electrical items to be painted.**>

## 3.4 FIELD QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:

1. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
2. Testing agency will perform tests for compliance with product requirements.
3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

## 3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

## 3.6 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Nontraffic Surfaces:

1. Latex System: MPI INT 3.1E.

    a. Prime Coat: Interior latex matching topcoat.
    b. Intermediate Coat: Interior latex matching topcoat.
    c. Topcoat: Interior latex [**(flat)**] [**(low sheen)**] [**(eggshell)**] [**(satin)**] [**(semigloss)**] [**(gloss)**].

2. Latex Over Sealer System: MPI INT 3.1A.

    a. Prime Coat: Interior latex primer/sealer.
    b. Intermediate Coat: Interior latex matching topcoat.
    c. Topcoat: Interior latex [**(flat)**] [**(low sheen)**] [**(eggshell)**] [**(satin)**] [**(semigloss)**] [**(gloss)**].

3. Latex Over Latex Aggregate System: MPI INT 3.1B.

    a. Prime Coat: Latex stucco and masonry textured coating.
    b. Intermediate Coat: Exterior latex matching topcoat.
    c. Topcoat: Exterior latex [**(flat)**] [**(semigloss)**] [**(gloss)**].

4. Alkyd System: MPI INT 3.1D.

    a. Prime Coat: Interior latex primer/sealer.
    b. Intermediate Coat: Interior alkyd matching topcoat.
    c. Topcoat: Interior alkyd [**(flat)**] [**(eggshell)**] [**(semigloss)**] [**(gloss)**].

5. Institutional Low-Odor/VOC Latex System: MPI INT 3.1M.

    a. Prime Coat: Institutional low-odor/VOC interior latex matching topcoat.
    b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
    c. Topcoat: Institutional low-odor/VOC interior latex [**(flat)**] [**(low sheen)**] [**(eggshell)**] [**(semigloss)**].

6. High-Performance Architectural Latex System: MPI INT 3.1C.

    a. Prime Coat: Interior latex primer/sealer.
    b. Intermediate Coat: High-performance architectural latex matching topcoat.
    c. Topcoat: High-performance architectural latex [**(low sheen)**] [**(eggshell)**] [**(satin)**] [**(semigloss)**].

B. Concrete Substrates, Traffic Surfaces:

1. Latex Floor Enamel System: MPI INT 3.2A.

    a. Prime Coat: Interior/exterior latex floor and porch paint (low gloss).
    b. Intermediate Coat: Interior/exterior latex floor and porch paint (low gloss).
    c. Topcoat: Interior/exterior latex floor and porch paint (low gloss).

2. Alkyd Floor Enamel System: MPI INT 3.2B.

    a. Prime Coat: Exterior/interior alkyd floor enamel (gloss).
    b. Intermediate Coat: Exterior/interior alkyd floor enamel (gloss).
    c. Topcoat: Exterior/interior alkyd floor enamel (gloss).

3. Concrete Stain System: MPI INT 3.2E.

    a. First Coat: Interior concrete floor stain.
    b. Topcoat: Interior concrete floor stain.

4. Clear Sealer System: MPI INT 3.2F.

    a. First Coat: Interior/exterior clear concrete floor sealer (solvent based).
    b. Topcoat: Interior/exterior clear concrete floor sealer (solvent based).

5. Water-Based Clear Sealer System: MPI INT 3.2G.

    a. First Coat: Interior/exterior clear concrete floor sealer (water based).
    b. Topcoat: Interior/exterior clear concrete floor sealer (water based).

C. Clay-Masonry Substrates:

1. Latex System: MPI INT 4.1A.

a. Prime Coat: Interior latex matching topcoat.
b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Interior latex [**(flat)**] [**(low sheen)**] [**(eggshell)**] [**(satin)**] [**(semigloss)**] [**(gloss)**].

2. Alkyd System: MPI INT 4.1D.

a. Prime Coat: Interior latex primer/sealer.
b. Intermediate Coat: Interior alkyd matching topcoat.
c. Topcoat: Interior alkyd [**(flat)**] [**(eggshell)**] [**(semigloss)**] [**(gloss)**].

3. Latex Aggregate System: MPI INT 4.1B.

a. Prime Coat: As recommended in writing by topcoat manufacturer.
b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
c. Topcoat: Latex stucco and masonry textured coating.

4. Institutional Low-Odor/VOC Latex System: MPI INT 4.1M.

a. Prime Coat: Institutional low-odor/VOC interior latex matching topcoat.
b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
c. Topcoat: Institutional low-odor/VOC interior latex [**(flat)**] [**(low sheen)**] [**(eggshell)**] [**(semigloss)**].

5. High-Performance Architectural Latex System: MPI INT 4.1L.

a. Prime Coat: High-performance architectural latex matching topcoat.
b. Intermediate Coat: High-performance architectural latex matching topcoat.
c. Topcoat: High-performance architectural latex [**(low sheen)**] [**(eggshell)**] [**(satin)**] [**(semigloss)**].

D. CMU Substrates:

1. Latex System: MPI INT 4.2A.

a. Prime Coat: Interior/exterior latex block filler.
b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Interior latex [**(flat)**] [**(low sheen)**] [**(eggshell)**] [**(satin)**] [**(semigloss)**] [**(gloss)**].

2. Alkyd System: MPI INT 4.2C.

a. Prime Coat: Interior/exterior latex block filler.
b. Intermediate Coat: Interior alkyd matching topcoat.
c. Topcoat: Interior alkyd [**(flat)**] [**(eggshell)**] [**(semigloss)**] [**(gloss)**].

3. Alkyd Over Latex Sealer System: MPI INT 4.2N.

a. Prime Coat: Interior/exterior latex block filler.
b. Sealer Coat: Interior latex primer/sealer.
c. Intermediate Coat: Interior alkyd matching topcoat.

d. Topcoat: Interior alkyd [**(flat)**] [**(eggshell)**] [**(semigloss)**] [**(gloss)**].

4. Institutional Low-Odor/VOC Latex System: MPI INT 4.2E.

a. Prime Coat: Interior/exterior latex block filler.
b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
c. Topcoat: Institutional low-odor/VOC interior latex [**(flat)**] [**(low sheen)**] [**(eggshell)**] [**(semigloss)**].

5. High-Performance Architectural Latex System: MPI INT 4.2D.

a. Prime Coat: Interior/exterior latex block filler.
b. Intermediate Coat: High-performance architectural latex matching topcoat.
c. Topcoat: High-performance architectural latex [**(low sheen)**] [**(eggshell)**] [**(satin)**] [**(semigloss)**].

E. Steel Substrates:

1. Quick-Drying Enamel System: MPI INT 5.1A.

a. Prime Coat: Quick-drying alkyd metal primer.
b. Intermediate Coat: Quick-drying enamel matching topcoat.
c. Topcoat: Quick-drying enamel [**(semigloss)**] [**(high gloss)**].

2. Water-Based Dry-Fall System: MPI INT 5.1C.

a. Prime Coat: [**Alkyd anticorrosive**] [**Quick-drying alkyd**] metal primer.
b. Topcoat: [**Latex dry fog/fall**] [**Waterborne dry fall**].

3. Alkyd Dry-Fall System: MPI INT 5.1D.

a. Prime Coat: [**Alkyd anticorrosive**] [**Quick-drying alkyd**] metal primer.
b. Topcoat: Interior alkyd dry fog/fall.

4. Latex Over Alkyd Primer System: MPI INT 5.1Q.

a. Prime Coat: [**Alkyd anticorrosive**] [**Quick-drying alkyd**] metal primer.
b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Interior latex [**(flat)**] [**(low sheen)**] [**(eggshell)**] [**(satin)**] [**(semigloss)**] [**(gloss)**].

5. Alkyd System: MPI INT 5.1E.

a. Prime Coat: [**Alkyd anticorrosive**] [**Quick-drying alkyd**] metal primer.
b. Intermediate Coat: Interior alkyd matching topcoat.
c. Topcoat: Interior alkyd [**(flat)**] [**(eggshell)**] [**(semigloss)**] [**(gloss)**].

6. Aluminum Paint System: MPI INT 5.1M.

a. Prime Coat: [**Alkyd anticorrosive**] [**Quick-drying alkyd**] metal primer.
b. Intermediate Coat: Aluminum paint.
c. Topcoat: Aluminum paint.

7. Institutional Low-Odor/VOC Latex System: MPI INT 5.1S.

    a. Prime Coat: Rust-inhibitive primer (water based).
    b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
    c. Topcoat: Institutional low-odor/VOC interior latex [**(flat)**] [**(low sheen)**] [**(eggshell)**] [**(semigloss)**].

8. High-Performance Architectural Latex System: MPI INT 5.1R.

    a. Prime Coat: [**Alkyd anticorrosive**] [**Quick-drying alkyd**] metal primer.
    b. Intermediate Coat: High-performance architectural latex matching topcoat.
    c. Topcoat: High-performance architectural latex [**(low sheen)**] [**(eggshell)**] [**(satin)**] [**(semigloss)**].

F. Galvanized-Metal Substrates:

1. Water-Based Dry-Fall System: MPI INT 5.3H.

    a. Prime Coat: Waterborne dry fall.
    b. Topcoat: Waterborne dry fall.

2. Alkyd Dry-Fall System: MPI INT 5.3F.

    a. Prime Coat: Cementitious galvanized-metal primer.
    b. Topcoat: Interior alkyd dry fog/fall.

3. Latex System: MPI INT 5.3A.

    a. Prime Coat: Cementitious galvanized-metal primer.
    b. Intermediate Coat: Interior latex matching topcoat.
    c. Topcoat: Interior latex [**(flat)**] [**(low sheen)**] [**(eggshell)**] [**(satin)**] [**(semigloss)**] [**(gloss)**].

4. Latex Over Waterborne Primer System: MPI INT 5.3J.

    a. Prime Coat: Waterborne galvanized-metal primer.
    b. Intermediate Coat: Interior latex matching topcoat.
    c. Topcoat: Interior latex [**(flat)**] [**(low sheen)**] [**(eggshell)**] [**(satin)**] [**(semigloss)**] [**(gloss)**].

5. Alkyd System: MPI INT 5.3C.

    a. Prime Coat: Cementitious galvanized-metal primer.
    b. Intermediate Coat: Interior alkyd matching topcoat.
    c. Topcoat: Interior alkyd [**(flat)**] [**(eggshell)**] [**(semigloss)**] [**(gloss)**].

6. Aluminum Paint System: MPI INT 5.3G.

    a. Prime Coat: Cementitious galvanized-metal primer.
    b. Intermediate Coat: Aluminum paint.
    c. Topcoat: Aluminum paint.

7. Institutional Low-Odor/VOC Latex System: MPI INT 5.3N.

    a. Prime Coat: Waterborne galvanized-metal primer.
    b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
    c. Topcoat: Institutional low-odor/VOC interior latex [**(flat)**] [**(low sheen)**] [**(eggshell)**] [**(semigloss)**].

8. High-Performance Architectural Latex System: MPI INT 5.3M.

    a. Prime Coat: Waterborne galvanized-metal primer.
    b. Intermediate Coat: High-performance architectural latex matching topcoat.
    c. Topcoat: High-performance architectural latex [**(low sheen)**] [**(eggshell)**] [**(satin)**] [**(semigloss)**].

G. Aluminum (Not Anodized or Otherwise Coated) Substrates:

1. Latex System: MPI INT 5.4H.

    a. Prime Coat: Quick-drying primer for aluminum.
    b. Intermediate Coat: Interior latex matching topcoat.
    c. Topcoat: Interior latex [**(flat)**] [**(low sheen)**] [**(eggshell)**] [**(satin)**] [**(semigloss)**] [**(gloss)**].

2. Alkyd Over Vinyl Wash Primer System: MPI INT 5.4A.

    a. Prime Coat: Vinyl wash primer.
    b. Intermediate Coat: Interior alkyd matching topcoat.
    c. Topcoat: Interior alkyd [**(flat)**] [**(eggshell)**] [**(semigloss)**] [**(gloss)**].

3. Alkyd Over Quick-Drying Primer System: MPI INT 5.4J.

    a. Prime Coat: Quick-drying primer for aluminum.
    b. Intermediate Coat: Interior alkyd matching topcoat.
    c. Topcoat: Interior alkyd [**(flat**] [**(eggshell)**] [**(semigloss)**] [**(gloss)**].

4. Aluminum Paint System: MPI INT 5.4D.

    a. Prime Coat: Vinyl wash primer.
    b. Intermediate Coat: Aluminum paint.
    c. Topcoat: Aluminum paint.

5. Institutional Low-Odor/VOC Latex System: MPI INT 5.4G.

    a. Prime Coat: Quick-drying primer for aluminum.
    b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
    c. Topcoat: Institutional low-odor/VOC interior latex [**(flat)**] [**(low sheen)**] [**(eggshell)**] [**(semigloss)**].

6. High-Performance Architectural Latex System: MPI INT 5.4F.

    a. Prime Coat: Quick-drying primer for aluminum.
    b. Intermediate Coat: High-performance architectural latex matching topcoat.

c. Topcoat: High-performance architectural latex [**(low sheen)**] [**(eggshell)**] [**(satin)**] [**(semigloss)**].

H. Glue-Laminated Beam and Column Substrates:

1. Latex System: MPI INT 6.1M.

a. Prime Coat: Interior latex-based wood primer.
b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Interior latex [**(flat)**] [**(low sheen)**] [**(eggshell)**] [**(satin)**] [**(semigloss)**] [**(gloss)**].

2. Latex Over Alkyd Primer System: MPI INT 6.1A.

a. Prime Coat: Interior alkyd primer/sealer.
b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Interior latex [**(flat)**] [**(low sheen)**] [**(eggshell)**] [**(satin)**] [**(semigloss)**] [**(gloss)**].

3. Alkyd System: MPI INT 6.1B.

a. Prime Coat: Interior alkyd primer/sealer.
b. Intermediate Coat: Interior alkyd matching topcoat.
c. Topcoat: Interior alkyd [**(flat)**] [**(eggshell)**] [**(semigloss)**] [**(gloss)**].

4. Institutional Low-Odor/VOC Latex System: MPI INT 6.1Q.

a. Prime Coat: Interior latex-based wood primer.
b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
c. Topcoat: Institutional low-odor/VOC interior latex [**(flat)**] [**(low sheen)**] [**(eggshell)**] [**(semigloss)**].

5. High-Performance Architectural Latex System: MPI INT 6.1N.

a. Prime Coat: Interior latex-based wood primer.
b. Intermediate Coat: High-performance architectural latex matching topcoat.
c. Topcoat: High-performance architectural latex [**(low sheen)**] [**(eggshell)**] [**(satin)**] [**(semigloss)**].

I. Dressed Lumber Substrates: Including [**architectural woodwork**] [**doors**] <**Insert description**>.

1. Latex System: MPI INT 6.3T.

a. Prime Coat: Interior latex-based wood primer.
b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Interior latex [**(semigloss)**] [**(gloss)**].

2. Latex Over Alkyd Primer System: MPI INT 6.3U.

a. Prime Coat: Interior alkyd primer/sealer.
b. Intermediate Coat: Interior latex matching topcoat.

c. Topcoat: Interior latex [**(semigloss)**] [**(gloss)**].

3. Alkyd System: MPI INT 6.3B.

a. Prime Coat: Interior alkyd primer/sealer.
b. Intermediate Coat: Interior alkyd matching topcoat.
c. Topcoat: Interior alkyd [**(eggshell)**] [**(semigloss)**] [**(gloss)**].

4. Institutional Low-Odor/VOC Latex System: MPI INT 6.3V.

a. Prime Coat: Interior latex-based wood primer.
b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
c. Topcoat: Institutional low-odor/VOC interior latex [**(flat)**] [**(low sheen)**] [**(eggshell)**] [**(semigloss)**].

5. High-Performance Architectural Latex System: MPI INT 6.3A.

a. Prime Coat: Interior latex-based wood primer.
b. Intermediate Coat: High-performance architectural latex matching topcoat.
c. Topcoat: High-performance architectural latex [**(low sheen)**] [**(eggshell)**] [**(satin)**] [**(semigloss)**].

J. Wood Panel Substrates: Including [**painted plywood**] [**medium-density fiberboard**] [**hardboard**] <**Insert description**>.

1. Latex System: MPI INT 6.4R.

a. Prime Coat: Interior latex-based wood primer.
b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Interior latex [**(semigloss)**] [**(gloss)**].

2. Latex Over Alkyd Primer System: MPI INT 6.4A.

a. Prime Coat: Interior alkyd primer/sealer.
b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Interior latex [**(flat)**] [**(low sheen)**] [**(eggshell)**] [**(satin)**] [**(semigloss)**] [**(gloss)**].

3. Alkyd System: MPI INT 6.4B.

a. Prime Coat: Interior alkyd primer/sealer.
b. Intermediate Coat: Interior alkyd matching topcoat.
c. Topcoat: Interior alkyd [**(flat)**] [**(eggshell)**] [**(semigloss)**] [**(gloss)**].

4. Institutional Low-Odor/VOC Latex System: MPI INT 6.4T.

a. Prime Coat: Interior latex-based wood primer.
b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
c. Topcoat: Institutional low-odor/VOC interior latex [**(flat)**] [**(low sheen)**] [**(eggshell)**] [**(semigloss)**].

5. High-Performance Architectural Latex System: MPI INT 6.4S.

a. Prime Coat: Interior latex-based wood primer.
b. Intermediate Coat: High-performance architectural latex matching topcoat.
c. Topcoat: High-performance architectural latex [**(low sheen)**] [**(eggshell)**] [**(satin)**] [**(semigloss)**].

K. Dimension Lumber Substrates, Nontraffic Surfaces: Including [**exposed joists**] [**exposed beams**] <**Insert description**>.

1. Latex System: MPI INT 6.2D.

a. Prime Coat: Interior latex-based wood primer.
b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Interior latex [**(flat)**] [**(low sheen)**] [**(eggshell)**] [**(satin)**] [**(semigloss)**] [**(gloss)**].

2. Latex Over Alkyd Primer System: MPI INT 6.2A.

a. Prime Coat: Interior alkyd primer/sealer.
b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Interior latex [**(flat)**] [**(low sheen)**] [**(eggshell)**] [**(satin)**] [**(semigloss)**] [**(gloss)**].

3. Alkyd System: MPI INT 6.2C.

a. Prime Coat: Interior alkyd primer/sealer.
b. Intermediate Coat: Interior alkyd matching topcoat.
c. Topcoat: Interior alkyd [**(flat)**] [**(eggshell)**] [**(semigloss)**] [**(gloss)**].

4. Institutional Low-Odor/VOC Latex System: MPI INT 6.2L.

a. Prime Coat: Interior latex-based wood primer.
b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
c. Topcoat: Institutional low-odor/VOC interior latex [**(flat)**] [**(low sheen)**] [**(eggshell)**] [**(semigloss)**].

5. High-Performance Architectural Latex System: MPI INT 6.2B.

a. Prime Coat: Interior alkyd primer/sealer.
b. Intermediate Coat: High-performance architectural latex matching topcoat.
c. Topcoat: High-performance architectural latex [**(low sheen)**] [**(eggshell)**] [**(satin)**] [**(semigloss)**].

L. Wood Substrates, Traffic Surfaces:

1. Latex Floor Paint System: MPI INT 6.5G.

a. Prime Coat: Interior alkyd primer/sealer.
b. Intermediate Coat: Interior/exterior latex floor and porch paint (low gloss).
c. Topcoat: Interior/exterior latex floor and porch paint (low gloss).

2. Alkyd Floor Enamel System: MPI INT 6.5A.

a. Prime Coat: Exterior/interior alkyd floor enamel (gloss).
b. Intermediate Coat: Exterior/interior alkyd floor enamel (gloss).
c. Topcoat: Exterior/interior alkyd floor enamel (gloss).

M. Gypsum Board Substrates:

1. Latex System: MPI INT 9.2A.

a. Prime Coat: Interior latex [**primer/sealer**] [**matching topcoat**].
b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Interior latex [**(flat)**] [**(low sheen)**] [**(eggshell)**] [**(satin)**] [**(semigloss)**] [**(gloss)**].

2. Alkyd Over Latex Primer System: MPI INT 9.2C.

a. Prime Coat: Interior latex primer/sealer.
b. Intermediate Coat: Interior alkyd matching topcoat.
c. Topcoat: Interior alkyd [**(flat)**] [**(eggshell)**] [**(semigloss)**] [**(gloss)**].

3. Institutional Low-Odor/VOC Latex System: MPI INT 9.2M.

a. Prime Coat: Interior latex primer/sealer.
b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
c. Topcoat: Institutional low-odor/VOC interior latex [**(flat)**] [**(low sheen)**] [**(eggshell)**] [**(semigloss)**].

4. High-Performance Architectural Latex System: MPI INT 9.2B.

a. Prime Coat: Interior latex primer/sealer.
b. Intermediate Coat: High-performance architectural latex matching topcoat.
c. Topcoat: High-performance architectural latex [**(low sheen)**] [**(eggshell)**] [**(satin)**] [**(semigloss)**].

N. Plaster Substrates:

1. Latex System: MPI INT 9.2A.

a. Prime Coat: Interior latex [**primer/sealer**] [**matching topcoat**].
b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Interior latex [**(flat)**] [**(low sheen)**] [**(eggshell)**] [**(satin)**] [**(semigloss)**] [**(gloss)**].

2. Latex Over Alkyd Primer System: MPI INT 9.2K.

a. Prime Coat: Interior alkyd primer/sealer.
b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Interior latex [**(flat)**] [**(low sheen)**] [**(eggshell)**] [**(satin)**] [**(semigloss)**] [**(gloss)**].

3. Alkyd Over Latex Primer System: MPI INT 9.2C.

a. Prime Coat: Interior latex primer/sealer.

b. Intermediate Coat: Interior alkyd matching topcoat.
c. Topcoat: Interior alkyd [**(flat)**] [**(eggshell)**] [**(semigloss)**] [**(gloss)**].

4. Institutional Low-Odor/VOC Latex System: MPI INT 9.2M.

a. Prime Coat: Interior latex primer/sealer.
b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
c. Topcoat: Institutional low-odor/VOC interior latex [**(flat)**] [**(low sheen)**] [**(eggshell)**] [**(semigloss)**].

5. High-Performance Architectural Latex System: MPI INT 9.2B.

a. Prime Coat: Interior latex primer/sealer.
b. Intermediate Coat: High-performance architectural latex matching topcoat.
c. Topcoat: High-performance architectural latex [**(low sheen)**] [**(eggshell)**] [**(satin)**] [**(semigloss)**].

O. Spray-Textured Ceiling Substrates:

1. Latex (Flat) System: MPI INT 9.1A, spray applied.

a. Prime Coat: Interior latex [**primer/sealer**] [**(flat)**].
b. Topcoat: Interior latex (flat).

2. Latex System: MPI INT 9.1E, spray applied.

a. Prime Coat: Interior latex matching topcoat.
b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Interior latex [**(flat)**] [**(low sheen)**] [**(eggshell)**] [**(satin)**] [**(semigloss)**].

3. Latex Over Alkyd Primer System: MPI INT 9.1B.

a. Prime Coat: Interior alkyd primer/sealer.
b. Topcoat: Interior latex [**(flat)**] [**(low sheen)**] [**(eggshell)**] [**(satin)**] [**(semigloss)**] [**(gloss)**].

4. Alkyd (Flat) System: MPI INT 9.1C.

a. Prime Coat: Interior alkyd (flat).
b. Topcoat: Interior alkyd (flat).

5. Alkyd System: MPI INT 9.1D.

a. Prime Coat: Interior alkyd primer/sealer.
b. Intermediate Coat: Interior alkyd matching topcoat.
c. Topcoat: Interior alkyd [**(eggshell)**] [**(semigloss)**] [**(gloss)**].

P. Cotton or Canvas Insulation-Covering Substrates: Including [**pipe and duct coverings**] <**Insert description**>.

1. Latex System: MPI INT 10.1A.

a. Prime Coat: Interior latex [**primer/sealer**] [**matching topcoat**].
b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Interior latex [**(flat)**] [**(low sheen)**] [**(eggshell)**] [**(satin)**] [**(semigloss)**] [**(gloss)**].

2. Alkyd Over Latex Primer System: MPI INT 10.1B.

a. Prime Coat: Interior latex primer/sealer.
b. Intermediate Coat: Interior alkyd matching topcoat.
c. Topcoat: Interior alkyd [**(flat)**] [**(eggshell)**] [**(semigloss)**] [**(gloss)**].

3. Aluminum Paint System: MPI INT 10.1C.

a. Prime Coat: Interior latex primer/sealer.
b. Intermediate Coat: Aluminum paint.
c. Topcoat: Aluminum paint.

4. Institutional Low-Odor/VOC Latex System: MPI INT 10.1D.

a. Prime Coat: Interior latex primer/sealer.
b. Intermediate Coat: Institutional low-odor/VOC interior latex matching topcoat.
c. Topcoat: Institutional low-odor/VOC interior latex [**(flat)**] [**(low sheen)**] [**(eggshell)**] [**(semigloss)**].

END OF SECTION 09912

# DIVISION 14: CONVEYING EQUIPMENT

SECTION 14245 - HYDRAULIC FREIGHT ELEVATORS

a. GENERAL

a.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

a.2 SUMMARY

A. This Section includes hydraulic freight elevators.

B. Related Sections include the following:

1. Division 2 Section "Earthwork" for excavating well hole to accommodate cylinder assembly.
2. Division 2 Section "Earthwork" for disposition of excavated material from cylinder well hole.
3. Division 3 Section "Cast-in-Place Concrete" for setting sleeves, inserts, and anchoring devices in concrete.
4. Division 4 Section "Unit Masonry Assemblies" for setting sleeves, inserts, and anchoring devices in masonry.
5. Division 5 Section "Structural Steel" for the following:

    a. Attachment plates, angle brackets, and other preparation of structural steel for fastening guide-rail brackets.
    b. Divider beams.
    c. Hoist beams.
    d. Structural steel shapes for sub-sills and entrance frames that are part of steel frame.

6. Division 5 Section "Metal Fabrications" for the following:

    a. Attachment plates and angle brackets for supporting guide-rail brackets.
    b. Divider beams.
    c. Hoist beams.
    d. Structural-steel shapes for subsills and entrance frames.
    e. Pit ladders.
    f. Cants in hoistways made from steel sheet.

7. Division 5 Section "Pipe and Tube Railings" for railings between adjacent elevator pits.
8. Division 9 painting Sections for field painting of hoistway entrance doors and frames.
9. Division 10 Section "Wire Mesh Partitions" for guards between adjacent elevator pits.
10. Division 13 Section "Security Access" for security access system equipment used to restrict elevator use.

11. Division 13 Section "Fire Alarm" for smoke detectors in elevator lobbies to initiate emergency recall operation and heat detectors in shafts and machine rooms, for connection to elevator controllers.
12. Division 16 Sections for electrical service for elevators to and including fused disconnect switches at machine room door and standby power source, transfer switch, and connection from auxiliary contacts in transfer switch to controller.
13. Division 16 Section "Voice And Data Communication Cabling" for telephone service for elevators.

C. Unit Prices: Rock excavation for cylinder well holes will be paid for under the unit price indicated in the Contract and as specified in Division 1 Section "Unit Prices."

a.3 DEFINITIONS

A. Definitions in ASME A17.1 apply to work of this Section.

B. Defective Elevator Work: Operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.

a.4 SUBMITTALS

A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information.

B. Shop Drawings: Show plans, elevations, sections, and large-scale details indicating service at each landing, machine room layout, coordination with building structure, relationships with other construction, and locations of equipment and signals. Indicate variations from specified requirements, maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.

C. Samples for Initial Selection: For finishes involving color selection.

D. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway, pit, and machine room layout and dimensions, as shown on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.

E. Qualification Data: For Installer.

F. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include diagnostic and repair information available to manufacturer's and Installer's maintenance personnel.

G. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.

H. Warranty: Special warranty specified in this Section.

I. Continuing Maintenance Proposal: Service agreement specified in this Section.

a.5 QUALITY ASSURANCE

A. Installer Qualifications: Elevator manufacturer or manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain freight elevators through one source from a single manufacturer.

1. Provide major elevator components, including pump-and-tank units, plunger-cylinder assemblies, controllers, signal fixtures, door operators, car frames, cabs, and entrances, manufactured by a single manufacturer.

C. Regulatory Requirements: Comply with ASME A17.1 and elevator design requirements for earthquake loads in ASCE 7.

1. Effective peak velocity acceleration (Av) for Project's location is greater than or equal to 0.20 (seismic risk zones 3 and 4).
2. Design earthquake spectral response acceleration, short period (Sds) for Project is **1.2** (use geotechnical report or USGS seismic tool for exact site-specific value)
3. Project's seismic design category is **D**.
4. Elevator importance factor is **1.0**.

D. Accessibility Requirements: Comply with Section 4.10 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)." 407 in ICC A117.1.

E. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to **NFPA 252**.

a.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle materials, components and equipment in manufacturer's protective packaging.

B. Store materials, components, and equipment off of ground, under cover, and in a dry location. Handle according to manufacturer's written recommendations to prevent damage, deterioration, or soiling.

a.7 COORDINATION

A. Coordinate installation of sleeves, block outs, and items that are embedded in concrete or masonry for elevator equipment. Furnish templates and installation instructions and deliver to Project site in time for installation.

B. Furnish well casing and coordinate delivery with related excavation work.

C. Coordinate sequence of freight elevator installation with other work to avoid delaying the Work.

D. Coordinate locations and dimensions of other work relating to hydraulic freight elevators including pit ladders, sumps, and floor drains in pits; entrance subsills; and electrical service, electrical outlets, lights, and switches in pits and machine rooms.

a.8 WARRANTY

A. Special Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair, restore, or replace defective elevator work within specified warranty period.

1. Warranty Period: a minimum period of **twelve (12) months** from the date of **Substantial Completion** or **final acceptance**, whichever occurs later.

2. The warranty shall include:
   - Labor and materials required to correct any defects.
   - Travel time and transportation for warranty service.
   - Coverage for mechanical, electrical, control systems, and door equipment.

a.9 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide a minimum period of **twelve (12) months** full maintenance service by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

1. Perform maintenance, including emergency callback service, during normal working hours.
2. Include 24-hour-per-day, 7-day-per-week emergency callback service.

   a. Response Time: Two hours or less.

B. Continuing Maintenance Proposal: Provide a continuing maintenance proposal from Installer to Owner, in the form of a standard **five-year** maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options. Include optional renewal terms in **1- year or 2-year increments**.

C. Continuing Maintenance Proposal: Provide a continuing maintenance proposal from Installer to Owner with terms, conditions, and obligations as set forth in, and in the same form as, "Draft of Elevator Maintenance Agreement" at end of this Section, starting on date initial maintenance service is concluded.

b. PRODUCTS

b.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Fujitec America, Inc.
2. KONE Inc.
3. Otis Elevator Co.
4. Schindler Elevator Corp.
5. ThyssenKrupp Elevator.
6. COURION
7. EECO
8. MAD Elevator Inc.
9. ZZIPCO

b.2 SYSTEMS AND COMPONENTS

A. General: Provide manufacturer's standard freight elevator systems. Where components are not otherwise indicated, provide standard components published by manufacturer as included in standard pre-engineered freight elevator systems and as required for complete system.

B. Pump Units: Positive-displacement type with a maximum of 10 percent variation between no load and full load and with minimum pulsations. Provide the following:

1. Pump, with fan-cooled squirrel-cage induction motor, mounted on oil tank with vibration isolation mounts. Enclose pump in prime-painted steel enclosure lined with **1-inch- (25-mm-)** thick, glass-fiber insulation board.
2. Submersible pump, with submersible squirrel-cage induction motor, suspended inside oil tank from vibration isolation mounts.
3. Provide motor with **solid-state** starting.

C. Hydraulic Silencers: Provide hydraulic silencer containing pulsation-absorbing material in a blowout-proof housing at pump unit.

D. Piping: Provide size, type, and weight piping recommended by manufacturer, and provide flexible connectors to minimize sound and vibration transmissions from power unit.

1. Provide dielectric couplings at cylinder units.
2. Casing for Underground Piping: PVC pipe complying with ASTM D 1785, joined with PVC fittings complying with ASTM D 2466 and solvent cement complying with ASTM D 2564.

E. Hydraulic Fluid: Nontoxic, readily biodegradable, fire-resistant fluid made from vegetable oil with antioxidant, anticorrosive, antifoaming, and metal-passivating additives. Hydraulic fluid is approved by elevator manufacturer for use with elevator equipment.

1. Product: Subject to compliance with requirements, provide "Hydro Safe" by Hydro Safe Oil Division, Inc.

F. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work where installation of devices is specified in another Section.

G. Protective Cylinder Casing: PVC or HDPE pipe casing complying with ASME A17.1, of sufficient size to provide not less than 1-inch (25-mm) clearance from cylinder and extending above pit floor. Provide means to monitor casing effectiveness to comply with ASME A17.1.

H. Corrosion Protective Filler: A nontoxic, petroleum-based gel formulated for filling the space between hydraulic cylinder and protective casing. Filler is electrically nonconductive, displaces or absorbs water, and gels or solidifies at temperatures below 60 deg F (16 deg C).

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:

a. Hydro Safe Oil Division, Inc.; No-Ox-Id Liquid Elevator Casing Filler E-800. (prefer option for performance and safety).
b. Union-Gard, a division of Dome Services L.L.C.; Union-Gard 160.
c. T.L. Shield: CorroGuard

I. Car Frame and Platform: Welded steel units.

1. Provide special heavy-duty units where indicated for power truck loading, designed to withstand impacts and wheel loadings indicated.

J. Guides: Provide either roller guides or sliding guides at top and bottom of car and counterweight frames. If sliding guides are used, provide guide-rail lubricators or polymer-coated, nonlubricated guides.

## b.3 OPERATION SYSTEMS

A. General: Provide manufacturer's standard microprocessor operation system **for each elevator** as required to provide type of operation system indicated.

B. Battery-Powered Lowering: When power fails, car is lowered to the lowest floor, opens its doors, and shuts down. System includes rechargeable battery and automatic recharging system.

C. Load-Weighing Device: When car load exceeds 80 percent of rated capacity, a signal light is lit in the car control station; when car load exceeds rated capacity, car will not respond to car or hall calls.

D. Security Features: Provide the following security features, where indicated. Security features shall not affect emergency firefighters' service.

1. Card-Reader Operation: System don't uses card readers at **car control stations** or **hall push-button stations** to authorize calls. Security system determines which landings and at what times calls require authorization by card reader. Provide required conductors in traveling cable and panel in machine room for interconnecting card readers, other security access system equipment, and elevator controllers.

a. Security access system equipment is specified in Division 13 Section "Security Access."
b. Security access system equipment is not in the Contract.

2. Keyswitch Operation: Push buttons are activated and deactivated by security keyswitches at **car control stations.** Key is removable only in deactivated position. Provided Coded Key keeper box at Basement level.

## b.4 DOOR REOPENING DEVICES

A. Infrared Array: Provide door reopening devices with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more of the light beams shall cause doors to stop and reopen.

## b.5 FINISH MATERIALS

A. General: Provide the following materials for exposed parts of elevator car enclosures, car doors, hoistway entrance doors and frames, and signal equipment as indicated.

B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, commercial steel, Type B, exposed, matte finish.

C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, commercial steel, Type B, pickled.

D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, commercial steel, with G60 (Z180) zinc coating (galvanized) and for exposed areas that shall be finished with paint or powder coat A60 (ZF180) zinc-iron-alloy coating (galvannealed).

E. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304.

1. Textured Stainless-Steel Sheet: Product with **embossed** texture rolled into exposed surface.

a. Available Product: Subject to compliance with requirements, a product that may be incorporated into the Work includes, but is not limited to, "FREIGHT SERIES WALL SYSTEM" by Elevator Interior Design, Inc. (EID)

b. Product: Subject to compliance with requirements, provide "Modular Freight Cab Interiors" by SnapCab® – Freight Cab Series

c.

F. Stainless-Steel Bars: ASTM A 276, Type 304.

G. Stainless-Steel Tubing: ASTM A 554, Grade MT 304.

H. Rolled Steel Floor Plate: ASTM A 786/A 786M.

I. Rolled Stainless-Steel Floor Plate: ASTM A 793.

J. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Pattern 1, Alloy 6061-T6.

b.6 CAR ENCLOSURES

A. General: Provide car enclosures as indicated, including ventilation, lighting, finishes, access doors, thresholds, trim, and accessories. Fabricate with recesses and cutouts for signal equipment.

1. Provide power door operators with linkages for hoistway door operation.
2. Provide standard railings complying with ASME A17.1 on car tops where required by ASME A17.1.

B. Materials and Fabrication: Provide manufacturer's standard, flush panel, welded construction made from metal sheet, of metal indicated, not less than 0.067 inch (1.7 mm) and reinforced at 16-inch (406-mm) maximum spacing.

1. Provide perforated panels for ceiling and for walls above 72 inches (1829 mm) from car floor unless required to be solid by ASME A17.1.

b.7 HOISTWAY ENTRANCES

A. General: Structural-steel frames and sills for hoistway entrances are specified in Division 5 Section **Structural Steel**. Unless otherwise indicated, provide hoistway entrance doors of type indicated below, with truckable sill bars and resilient safety meeting-rail gaskets.

1. Equip for power operation by means of coordinated linkage with power-operated car door.
2. Where gypsum board wall construction is indicated, provide fire-resistance-rated, hollow-metal, door-and-frame hoistway entrances. Provide self-supporting frames with reinforced head sections.

B. Materials and Fabrication: Provide manufacturer's standards, but not less than the following:

1. Metal Door Panels: Constructed of metal sheets, flush on room side, welded and reinforced in steel framing with vertical reinforcing spaced not more than 24 inches (610 mm) o.c. Fabricate panel faces from metal sheet, of metal indicated, not less than 0.097 inch (2.5 mm) thick.

b.8 SIGNAL EQUIPMENT

A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Fabricate lighted elements of acrylic or other permanent, nonyellowing translucent plastic.

B. Car Control Stations: Provide manufacturer's standard car control station. Mount adjacent to car door, unless otherwise indicated.

1. Mark buttons and switches with manufacturer's standard identification for required use or function that complies with ASME A17.1. Use both tactile symbols and Braille.
2. Mount controls at heights complying with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG) and ICC A117.1.

C. Emergency Communication System: Provide system that complies with ASME A17.1 and the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Building and Facilities (ADAAG)." On activation, system dials preprogrammed number of monitoring station and identifies elevator location to monitoring station. System provides two-way voice communication without using a handset and provides visible signals that indicate when system has been activated and when monitoring station has responded. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.

D. Firefighters' Two-Way Telephone Communication Service: **Provide a flush-mounted cabinet two-way telephone communication system for firefighter emergency use** in each car and required conductors in traveling cable for firefighters' two-way telephone communication service specified in Division 13 Section "Fire Alarm."

E. Car Position Indicator: Provide illuminated digital-type car position indicator, located above car door or above car control station.

F. Hall Push-Button Stations: Provide hall push-button stations at each landing as indicated.

1. Provide single-button stations with **position** and **"In-Use"** indicator.
"In-Use" Indicator:
- A dedicated visual signal (e.g., LED light) to indicate when the elevator is:
    - Occupied ("In-Use") – Red or amber light.
    - Available – Green light or off.

b.9 ELEVATORS

A. Elevator No.: 7

1. Type: Under-the-car **single** cylinder.
2. Rated Load: **5000 lb (2270 kg)**.
3. Freight Loading Class: Class **A**
4. Rated Speed (Up): **150 ft/min** (0.75 m/s)
5. Operational Speed (Down): **Approximately 30 percent more than** rated speed (up).
6. Operation System: **Single automatic** operation.

7. Auxiliary Operations: **Keyswitch operation**
8. Auxiliary Car Control Station: N/A
9. Car Enclosures:

    a. Platform Width: **100 inches (2540 mm)**
    b. Platform Depth: **120 inches (3048 mm)**
    c. Ceiling Height: **103 inches (2616 mm)**
    d. Walls and Ceiling: **Prime-painted steel**] [**Prime-painted, metallic-coated steel**] [**Satin stainless steel, No. 4 finish**] [**Textured stainless steel**].
    e. Car Fixtures: Satin stainless steel, No. 4 finish.
    f. Floor: **Rolled steel floor plate**
    g. Car Gate Type: **bi-parting**, **Single-speed vertical lift**
    h. Car Gate Operation: **Power operated**.
    i. Car Gate Material: **Prime-painted steel**
    j. Car Sill: Steel angle.
    k. Lighting: **Two** 48-inch (1219-mm), flush mounted, **2**-tube LED light fixture(s) with UV stabilized acrylic diffusers not less than 0.125 inch (3.2 mm) thick**.**

10. Hoistway Entrances:

    a. Width: **96 inches (2438 mm)**
    b. Height: **96 inches (2438 mm)**
    c. Door Type: **bi-parting**, **Single-speed vertical lift**
    d. Fire-Protection Rating: **1-1/2 hours**, **with 30-minute temperature rise of 450 deg F (250 deg C)**].
    e. Door Operation: **Power operated**
    f. Door Material: **Prime-painted steel**
    g. Door Frame Material: **Prime-painted steel**
    h. Door **frames and** sills are specified in Division 5 Section **Metal Fabrications**.

11. Hall Fixtures: Satin stainless steel, No. 4 finish.
12. Auxiliary Hall Stations: N/A
13. Additional Requirements:

    a. Provide door reopening device.

c. EXECUTION

c.1 EXAMINATION

A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance. Verify critical dimensions and examine supporting structure and other conditions under which elevator work is to be installed.

1. For the record, prepare a written report, endorsed by Installer, listing dimensional discrepancies and conditions detrimental to performance or indicating that dimensions and conditions were found to be satisfactory.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

c.2 INSTALLATION

A. Excavation for Cylinder: Drill well hole in elevator pit to accommodate installation of cylinder; comply with applicable requirements in Division 2 Section "Earthwork."

B. Provide **waterproof** well casing **as necessary** to retain walls of well hole.

C. Install cylinder in protective casing within well hole. Before installing protective casing, remove water and debris from well hole **and provide permanent waterproof seal at bottom of well casing**.

1. Fill void space between protective casing and cylinder with corrosion-protective filler.
2. Align cylinders and fill space around protective casing with fine sand.

D. Install cylinder plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor. Seal between **protective** casing and pit floor with 4 inches (100 mm) of nonshrink, nonmetallic grout.

E. Install cylinder plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor and braced at intervals as needed to maintain alignment. Anchor cylinder guides at spacing needed to maintain alignment and avoid overstressing guides.

F. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.

G. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts designed to effectively prevent transmission of vibrations to structure and thereby eliminate sources of structure-borne noise from elevator system.

H. Install piping above the floor, where possible. Where not possible, install underground piping in Schedule 40 PVC pipe casing assembled with solvent-cemented fittings.

I. Install piping above the floor, where possible. Where not possible, cover underground piping with permanent protective wrapping before backfilling.

J. Lubricate operating parts of systems as recommended by manufacturers.

K. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay installation of sills and frames until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.

c.3 FIELD QUALITY CONTROL

A. Acceptance Testing: On completion of elevator installation and before permitting use (either temporary or permanent) of elevators, perform acceptance tests as required and recommended by ASME A17.1 and by governing regulations and agencies.

B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times tests are to be performed on elevators.

c.4 PROTECTION

A. Temporary Use: **Limit temporary use for construction purposes to one elevator.** Comply with the following requirements for elevator used for construction purposes:

1. Provide protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
2. Do not load elevators beyond their rated weight capacity.
3. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
4. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

c.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate**, adjust, and maintain** elevator(s). Refer to Division 1 Section "Demonstration and Training."

B. Check operation of elevator with Owner's personnel present and before date of Substantial Completion. Determine that operation systems and devices are functioning properly.

C. Check operation of elevator with Owner's personnel present not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

END OF SECTION 14245

## Section 14 24 00 – Hydraulic Freight Elevator

## OPERATING FEATURES (FREIGHT / SECURITY / SAFETY)

### A. General Operation

1. Provide microprocessor control for **automatic operation** with front (and rear, if provided) entrances, car and hall calls, door timing, re-leveling, and dispatch logic as required.
2. Comply with **ASME A17.1/CSA B44** (latest adopted edition), IBC/PRBC, NEC, and local AHJ requirements for signals, controls, and emergency functions.

### B. Power Door Operation (Freight Entrances)

1. Provide **closed-loop VVVF door operators** for each entrance (front and rear where applicable), with adjustable speeds, torque limits, and smooth start/stop.
2. Door control shall support **constant-pressure attendant control** and **automatic control** as selectable modes.
3. Provide **nudging** (reduced speed/force) after an adjustable dwell; nudging shall be inhibited while a person/object is detected by protective devices.

### C. Door Protective Device (Light/Laser Curtain)

1. Furnish a **full-height, multi-beam infrared light curtain** spanning the clear opening, detecting objects from sill to a minimum of 6 ft (1.8 m) above floor; fail-safe monitored.
2. On detection, doors **reopen**; protective device remains active in all normal/service modes except Inspection or where disabled by Firefighters' Emergency Operation per code.

### D. Signals and Annunciation

1. Car and hall lanterns/gongs, position indicators, "Door Open/Close," "In Use," and "Freight Service" indicators as scheduled.
2. Provide **service-side annunciation** when the car is in a loading/priority mode (see §H).

**E. Emergency Communications**

1. Provide **two-way, hands-free communications** per ASME A17.1 §2.27: illuminated HELP button, call status, and automatic location/ID transmission to a monitored station.
2. System shall provide **text/visual messaging** capability for hearing/speech-impaired users, and **battery backup** to maintain operation during power loss.

**F. Firefighters' Emergency Operation (FEO)**
Provide **Phase I recall** and **Phase II in-car operation** per ASME A17.1 and AHJ sequence. Door protective devices, nudging, and security features shall behave per code during FEO.

**G. Security / Access Control (Card or Key Operation)**

1. **Hall Call Lockout (HCL):** Provide inputs/outputs for **card reader or key switch** control at landings to enable/disable hall calls globally or by floor.
2. **Car Call Lockout (CCL):** Provide floor-by-floor **car call enable** via access system.
3. **Key Switches:** In-car keyed selector(s) for **Normal / Independent / Attendant / (Rear Enable, if applicable)**. Provide keyed **Emergency Power/Recall** if furnished by building.
4. Coordinate with Division 28 for **dry contacts/relays** or network interface; elevator controls shall remain **fail-safe to free egress** and code-required emergency functions.

**H. Loading / Service Priority Modes (Blocking Other Calls During Loading)**
Provide the following selectable modes to **prevent other floors from calling the elevator while it is used for loading**; show active mode via "**Freight Service**" indicator in car and at the active landing(s):

1. **Independent Service (IND):** Key-selectable in the car. **All hall calls are bypassed/ignored**; the car responds only to car calls. Doors remain open until **Close** is pressed; car will not start until doors are closed.
2. **Attendant Service (ATT):** Key-selectable in the car. Attendant has **constant-pressure** door control; **hall calls bypassed**; auto-door timing inhibited.
3. **Dock Hold / Load Hold:** Key or card command at a selected landing to **park the car at that floor with doors open**, **suspend hall calls**, extend

door timeouts, and inhibit nudging. Adjustable **time-out** restores Normal mode.
4. **Priority Service (optional):** Authorized user may seize the car; controller **cancels/bypasses pending hall calls** until priority trip is complete.

**I. Hydraulic-Specific Emergency Features**

1. **Emergency Power-Off/Stop** per code, and **automatic down-leveling** to nearest floor on power failure (battery-powered lowering valve or equivalent).
2. **Seismic/Earthquake operation** interface to building seismic switch (if required).
3. **Emergency lighting and ventilation** with timed operation from battery/inverter.

**J. Energy & Standby**

Provide car light/fan **auto-off** after adjustable idle time; instant restore on call or door cycle. Coordinate with security and code requirements.

**K. Interfaces and Monitoring**

1. Provide dry contacts or BACnet/Modbus gateway (if specified) for **car position, direction, in-service/out-of-service, door status, fire/recall status, and alarm**.
2. Provide inputs for **access control**, **fire alarm** signals, **seismic** signal, and **building power status**.

**L. Submittals—Matrix of Operations**

Provide a **Matrix of Operations** documenting all modes above (Normal, IND, ATT, Dock/Load Hold, FEO Ph I/II, Power Loss/Recovery, Seismic), door behavior, call acceptance, indicators, and security interactions, for Architect/AHJ review before fabrication.

# DIVISION 22 PLUMBING

# SECTION 22 05 11
# COMMON WORK RESULTS FOR PLUMBING

## PART 1 - GENERAL

### 1.1 DESCRIPTION

A. The requirements of this Section shall apply to all sections of Division 22.

B. Definitions:

1. Exposed: Piping and equipment exposed to view in finished rooms.
2. Exterior: Piping and equipment exposed to weather be it temperature, humidity, precipitation, wind or solar radiation.
3. RE: resident Engineer
4. OR: Owner’s Representative

### 1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.

D. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

E. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

F. Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT.

G. Section 03 30 00, CAST-IN-PLACE CONCRETE

H. Section 05 50 00, METAL FABRICATIONS.

I. Section 07 60 00, FLASHING AND SHEET METAL: Flashing for Wall and Roof Penetrations.

J. Section 07 84 00, FIRESTOPPING.

K. Section 07 92 00, JOINT SEALANTS.

L. Section 09 91 00, PAINTING.

M. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

N. Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT.

O. Section 22 07 11, PLUMBING INSULATION.

P. Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

Q. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

R. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

S. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

T. Examine all drawings and criteria sheets and all other Sections of the Specifications for requirements, which affect work under this Section whether or not such work is specifically mentioned in this Section.

**1.3 APPLICABLE PUBLICATIONS**

A. The publications listed below shall form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only

B. American Society of Mechanical Engineers (ASME):

B31.1-2013.....Power Piping

ASME Boiler and Pressure Vessel Code -

BPVC Section IX-2019.... Welding, Brazing, and Fusing Qualifications

C. American Society for Testing and Materials (ASTM):

A36/A36M-2019.....Standard Specification for Carbon Structural Steel

A575-96(2013)e1.....Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades

E84-2013a.....Standard Test Method for Surface Burning Characteristics of Building Materials

E119-2012a.....Standard Test Methods for Fire Tests of Building Construction and Materials

D. International Code Council, (ICC):

IBC-2018.....International Building Code

IPC-2018.....International Plumbing Code

E. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc:

SP-58-2018.....Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application and Installation

F. National Electrical Manufacturers Association (NEMA):

MG 1-2016.....Motors and Generators

G. National Fire Protection Association (NFPA):

51B-2019.....Standard for Fire Prevention During Welding, Cutting and Other Hot Work

54-2018.....National Fuel Gas Code

70-2020.....National Electrical Code (NEC)

99-2018.....Healthcare Facilities Code

H. NSF International (NSF):

5-2019.....Water Heaters, Hot Water Supply Boilers, and Heat Recovery Equipment

14-2019.....Plastic Piping System Components and Related Materials
61-2019.....Drinking Water System Components – Health Effects
372-2016.....Drinking Water System Components – Lead Content

**1.4 SUBMITTALS**

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 05 11, COMMON WORK RESULTS FOR PLUMBING", with applicable paragraph identification.

C. If the project is phased, contractors shall submit complete phasing plan/schedule with manpower levels prior to commencing work. The phasing plan shall be detailed enough to provide milestones in the process that can be verified.

D. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements, and all equipment that requires regular maintenance, calibration, etc are accessable from the floor or permanent work platform. It is the Contractor’s responsibility to ensure all submittals meet the Owner’s specifications and requirements and it is assumed by the Owner that all submittals do meet the specifications unless the Contractor has requested a variance in writing and approved by OR prior to the submittal. If at any time during the project it is found that any item does not meet the owner’s specifications and there was no variance approval the Contractor shall correct at no additional cost or time to the Owner even if a submittal was approved.

E. If equipment is submitted which differs in arrangement from that shown, provide documentation proving equivalent performance, design standards and drawings that show the rearrangement of all associated systems. Additionally, any impacts on ancillary equipment or services such as foundations, piping, and electrical shall be the Contractor’s responsibility to design, supply, and install at no additional cost or time to the Owner. Owner’s approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.

F. Prior to submitting shop drawings for approval, Contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.

G. Submittals and shop drawings for interdependent items, containing applicable descriptive information, shall be furnished together and complete in a group. Coordinate and properly integrate materials and equipment in each group to provide a completely compatible and efficient installation. Final review and approvals will be made only by groups.

H. Manufacturer's Literature and Data including: Manufacturer’s literature shall be submitted under the pertinent section rather than under this section.

1. Electric motor data and variable speed drive data shall be submitted with the driven equipment.
2. Equipment and materials identification.
3. Firestopping materials.
4. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
5. Wall, floor, and ceiling plates.

I. Coordination/Shop Drawings:

1. Submit complete consolidated and coordinated shop drawings for all new systems, and for existing systems that are in the same areas.
2. The coordination/shop drawings shall include plan views, elevations and sections of all systems and shall be on a scale of not less than 1:32 (3/8-inch equal to 1 foot). Clearly identify and dimension the proposed locations of the principal items of equipment. The drawings shall clearly show locations and adequate clearance for all equipment, piping, valves, control panels and other items. Show the access means for all items requiring access for operations and maintenance. Provide detailed coordination/shop drawings of all piping and duct systems. The drawings should include all lockout/tagout points for all energy/hazard sources for each piece of equipment. Coordinate lockout/tagout procedures and practices with local requirements.
3. Do not install equipment foundations, equipment or piping until coordination/shop drawings have been approved.

4. In addition, for plumbing systems, provide details of the following:
   a. Mechanical equipment rooms.
   b. Hangers, inserts, supports, and bracing.
   c. Pipe sleeves.
   d. Duct or equipment penetrations of floors, walls, ceilings, or roofs.

J. Rigging Plan: Provide documentation of the capacity and weight of the rigging and equipment intended to be used. The plan shall include the path of travel of the load, the staging area and intended access, and qualifications of the operator and signal person.

K. Plumbing Maintenance Data and Operating Instructions:
1. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.
2. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:
   a. Include complete list indicating all components of the systems.
   b. Include complete diagrams of the internal wiring for each item of equipment.
   c. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.
3. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment. Include in the listing belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.

L. Provide copies of approved plumbing equipment submittals to the Owner.

**1.5 QUALITY ASSURANCE**

A. Mechanical, electrical, and associated systems shall be safe, reliable, efficient, durable, easily and safely operable and maintainable, easily and safely accessible, and in compliance with applicable codes as specified. The systems shall be comprised of high quality institutional-class and industrial-class products of manufacturers that are experienced specialists in the required product lines. All construction firms and personnel shall be experienced and qualified specialists in industrial and institutional plumbing.

B. Products Criteria:

1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture, supply and servicing of the specified products for at least 5 years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least 5 years.
2. Equipment Service: There shall be permanent service organizations, authorized and trained by manufacturers of the equipment supplied, located within 160 km (100 miles) of the project. These organizations shall come to the site and provide acceptable service to restore operations within 4 hours of receipt of notification by phone, e-mail or fax in event of an emergency, such as the shut-down of equipment; or within 24 hours in a non-emergency. Names, mail and e-mail addresses and phone numbers of service organizations providing service under these conditions for (as applicable to the project): pumps, compressors, water heaters, critical instrumentation, computer workstation and programming shall be submitted for project record and inserted into the operations and maintenance manual.
3. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
4. The products and execution of work specified in Division 22 shall conform to the referenced codes and standards as required by the specifications. Local codes and amendments enforced by the local code official shall be enforced, if required by local authorities such as the natural gas supplier. If the local codes are more stringent, then the local code shall apply. Any conflicts shall be brought to the attention of the Owner’s Representative (OR).
5. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be of the same manufacturer and model number, or if different models are required they shall be of the same manufacturer and identical to the greatest extent possible (i.e., same model series).

6. Assembled Units: Performance and warranty of all components that make up an assembled unit shall be the responsibility of the manufacturer of the completed assembly.
7. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
8. Asbestos products or equipment or materials containing asbestos is prohibited.
9.

C. Welding: Before any welding is performed, Contractor shall submit a certificate certifying that welders comply with the following requirements:
   1. Qualify welding processes and operators for piping according to ASME BPVC, Section IX, "Welding and Brazing Qualifications". Provide proof of current certification to CO.
   2. Comply with provisions of ASME B31 series "Code for Pressure Piping".
   3. Certify that each welder and welding operator has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.
   4. All welds shall be stamped according to the provisions of the AWS or ASME as required herein and by the association code.

D. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the OR prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

E. Execution (Installation, Construction) Quality:
   1. All items shall be applied and installed in accordance with manufacturer's written instructions. Conflicts between the manufacturer's instructions and the contract documents shall be referred to the OR for resolution. Printed copies or electronic files of manufacturer’s installation instructions shall be provided to the OR at least 10 working days prior to commencing installation of any item.

2. All items that require access, such as for operating, cleaning, servicing, maintenance, and calibration, shall be easily and safely accessible by persons standing at floor level, or standing on permanent platforms, without the use of portable ladders. Examples of these items include but are not limited to: all types of valves, filters and strainers, transmitters, and control devices. Prior to commencing installation work, refer conflicts between this requirement and contract documents to OR for resolution. Failure of the Contractor to resolve or call attention to any discrepancies or deficiencies to the OR will result in the Contractor correcting at no additional cost or time to the Owner.

3. Complete layout drawings shall be required by Paragraph, SUBMITTALS. Construction work shall not start on any system until the layout drawings have been approved by OR.
4. Installer Qualifications: Installer shall be licensed and shall provide evidence of the successful completion of at least five projects of equal or greater size and complexity. Provide tradesmen skilled in the appropriate trade.
5. Workmanship/craftsmanship will be of the highest quality and standards. The Owner reserves the right to reject any work based on poor quality of workmanship this work shall be removed and done again at no additional cost or time to the Owner.

F. Upon request by Owner, provide lists of previous installations for selected items of equipment. Include contact persons who will serve as references, with current telephone numbers and e-mail addresses.

G. Guaranty: Warranty of Construction, FAR clause 52.246-21.

H. Plumbing Systems: IPC, International Plumbing Code. Unless otherwise required herein, perform plumbing work in accordance with the latest version of the IPC. For IPC codes referenced in the contract documents, advisory provisions shall be considered mandatory, the word “should” shall be interpreted as “shall”. Reference to the “code official” or “owner” shall be interpreted to mean the OR.

I. Cleanliness of Piping and Equipment Systems:
1. Care shall be exercised in the storage and handling of equipment and piping material to be incorporated in the work. Debris arising from cutting, threading and welding of piping shall be removed.

2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.
3. The interior of all tanks shall be cleaned prior to delivery and beneficial use by the Owner. All piping shall be tested in accordance with the specifications and the International Plumbing Code (IPC). All filters, strainers, fixture faucets shall be flushed of debris prior to final acceptance.
4. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

**1.6 DELIVERY, STORAGE AND HANDLING**

A. Protection of Equipment:
1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the Owner has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage or theft.
2. Damaged equipment shall be replaced with an identical unit as determined and directed by the OR. Such replacement shall be at no additional cost or additional time to the Owner.
3. Interiors of new equipment and piping systems shall be protected against entry of foreign matter. Both inside and outside shall be cleaned before painting or placing equipment in operation.
4. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.
5. Protect plastic piping and tanks from ultraviolet light (sunlight) while in pre-construction. Plastic piping and tanks shall not be installed exposed to sunlight without metal jacketing to block ultraviolet rays.

**1.7 AS-BUILT DOCUMENTATION**

A. Submit manufacturer’s literature and data updated to include submittal review comments and any equipment substitutions.
B. Submit operation and maintenance data updated to include submittal review comments, Owner’s approved substitutions and construction revisions shall be in electronic version on CD inserted into a three—ring binder. All aspects of system operation and maintenance procedures, including applicable piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic,

and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

C. The installing Contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. Should the installing Contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement. Provide record drawings as follows:
   1. Red-lined, hand-marked drawings are to be provided, with one paper copy and a scanned PDF version of the hand-marked drawings provided on CD.
   2. As-built drawings are to be provided, with a copy of them on AutoCAD latest version provided on CD. The CAD drawings shall use multiple line layers with a separate individual layer for each system.

D. The as-built drawings shall indicate the location and type of all lockout/tagout points for all energy sources for all equipment and pumps to include breaker location and numbers, valve tag numbers, etc. Coordinate lockout/tagout procedures and practices with local Owner's requirements.

E. Certification documentation shall be provided to OR 21 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and provide documentation/certification that all results of tests were within limits specified. Test results shall contain written sequence of test procedure with written test results annotated at each step along with the expected outcome or setpoint. The results shall include all readings, including but not limited to data on device (make, model and performance characteristics_), normal pressures, switch ranges, trip points, amp readings, and calibration

data to include equipment serial numbers or individual identifications, etc.

**1.8 JOB CONDITIONS – WORK IN EXISTING BUILDING**

A. Building Operation: Location employees will be continuously operating and managing all facilities, including temporary facilities that serve the facility.

B. Maintenance of Service: Schedule all work to permit continuous service as required by the Owner's Representative.

C. Building Working Environment: Maintain the architectural and structural integrity of the building and the working environment at all times. Maintain the interior of building at 18 degrees C (65 degrees F) minimum. Limit the opening of doors, windows or other access openings to brief periods as necessary for rigging purposes. Storm water or ground water leakage is prohibited. Provide daily clean-up of construction and demolition debris on all floor surfaces and on all equipment being operated by Owner. Maintain all egress routes and safety systems/devices.

D. Acceptance of Work for Facility Operation: As new equipment, systems and facilities are made available for operation and these items are deemed of beneficial use to the Owner's, inspections and tests will be performed. Based on the inspections, a list of contract deficiencies will be issued to the Contractor. After correction of deficiencies as necessary for beneficial use, the Contracting Officer will process necessary acceptance and the equipment will then be under the control and operation of Owner personnel.

**PART 2 - PRODUCTS**

**2.1 MATERIALS FOR VARIOUS SERVICES**

A. See Piping specification on plumbing drawings

B. Plastic pipe, fittings and solvent cement shall meet NSF 14 and shall bear the NSF seal "NSF-PW". Polypropylene pipe and fittings shall comply with NSF 14 and NSF 61. Solder or flux containing lead shall not be used with copper pipe.

C. Material or equipment containing a weighted average of greater than 0.25 percent lead shall not be used in any potable water system intended for human consumption and shall be certified in accordance with NSF 61 or NSF 372.

D. In-line devices such as water meters, building valves, check valves, stops, valves, fittings, tanks and backflow preventers shall comply with NSF 61 and NSF 372.

E. End point devices such as drinking fountains, lavatory faucets, kitchen and bar faucets, ice makers supply stops, and end-point control valves used to dispense drinking water must meet requirements of NSF 61 and NSF 372.

**2.2 FACTORY-ASSEMBLED PRODUCTS**

A. Standardization of components shall be maximized to reduce spare part requirements.

B. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit.

1. All components of an assembled unit need not be products of same manufacturer.
2. Constituent parts that are alike shall be products of a single manufacturer.
3. Components shall be compatible with each other and with the total assembly for intended service.
4. Contractor shall guarantee performance of assemblies of components and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly at no additional cost or time to the Owner.

C. Components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.

D. Major items of equipment, which serve the same function, shall be the same make and model.

**2.3 COMPATIBILITY OF RELATED EQUIPMENT**

A. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational system that conforms to contract requirements.

**2.4 SAFETY GUARDS**

A. Equipment shall have moving parts protected from personal injury.

**2.5 LIFTING ATTACHMENTS**

A. Equipment shall be provided with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments

shall withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

**2.6 ELECTRIC MOTORS, MOTOR CONTROL, CONTROL WIRING**

A. All material and equipment furnished and installation methods used shall conform to the requirements of Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT. All electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems shall be provided. Premium efficient motors shall be provided. Unless otherwise specified for a particular application, electric motors shall have the following requirements.

B. Special Requirements:

1. Where motor power requirements of equipment furnished deviate from power shown on plans, provide electrical service designed under the requirements of NFPA 70 at no additional cost or time to the Owner.
2. Assemblies of motors, starters, and controls and interlocks on factory assembled and wired devices shall be in accordance with the requirements of this specification.
3. Wire and cable materials specified in the electrical division of the specifications shall be modified as follows:
   a. Wiring material located where temperatures can exceed 71° C (160° F) shall be stranded copper with Teflon FEP insulation with jacket. This includes wiring on the boilers and water heaters.
   b. Other wiring at boilers and water heaters, and to control panels, shall be NFPA 70 designation THWN.
   c. Shielded conductors or wiring in separate conduits for all instrumentation and control systems shall be provided where recommended by manufacturer of equipment.
4. Motor sizes shall be selected so that the motors do not operate into the service factor at maximum required loads on the driven equipment. Motors on pumps shall be sized for non-overloading at all points on the pump performance curves.
5. Motors utilized with variable frequency drives shall be rated “inverter-ready” per NEMA Standard, MG1.

C. Motor Efficiency and Power Factor: All motors, when specified as “high efficiency or Premium Efficiency” by the project specifications on driven equipment, shall conform to efficiency and power factor requirements in Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR

PLUMBING EQUIPMENT, with no consideration of annual service hours. Motor manufacturers generally define these efficiency requirements as "NEMA premium efficient" and the requirements generally exceed those of the Energy Policy Act (EPACT), revised 2005. Motors not specified as "high efficiency or premium efficient" shall comply with EPACT.

D. Single-phase Motors: Capacitor-start type for hard starting applications. Motors for centrifugal pumps may be split phase or permanent split capacitor (PSC).

E. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type. Each two-speed motor shall have two separate windings. A time delay (20 seconds minimum) relay shall be provided for switching from high to low speed.

F. Rating: Rating shall be continuous duty at 100 percent capacity in an ambient temperature of 40° C (104° F); minimum horsepower as shown on drawings; maximum horsepower in normal operation shall not exceed nameplate rating without service factor.

G. Insulation Resistance: Not less than one-half meg-ohm between stator conductors and frame shall be measured at the time of final inspection.

**2.7 VARIABLE SPEED MOTOR CONTROLLERS**

A. Refer to Section 26 05 11 for specifications.

B. The combination of controller and motor shall be provided by the respective pump manufacturer and shall be rated for 100 percent output performance. Multiple units of the same class of equipment, i.e. pumps, shall be product of a single manufacturer.

C. Motors shall be premium efficient type, "invertor duty", and be approved by the motor controller manufacturer. The controller-motor combination shall be guaranteed to provide full motor nameplate horsepower in variable frequency operation. Both driving and driven motor sheaves shall be fixed pitch.

D. Controller shall not add any current or voltage transients to the input AC power distribution system, DDC controls, sensitive medical equipment, etc., nor shall be affected from other devices on the AC power system.

**2.8 EQUIPMENT AND MATERIALS IDENTIFICATION**

A. Use symbols, nomenclature and equipment numbers specified, shown in the drawings, or shown in the maintenance manuals. Coordinate equipment and valve identification with local facility shops. In addition, provide bar code identification nameplate for all equipment which will allow

the equipment identification code to be scanned into the system for maintenance and inventory tracking. Identification for piping is specified in Section 09 91 00, PAINTING.

B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 7 mm (3/16 inch) high of brass with black-filled letters, or rigid black plastic with white letters specified in Section 09 91 00, PAINTING shall be permanently fastened to the equipment. Unit components such as water heaters, tanks, coils, filters, etc. shall be identified.

C. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 7 mm (3/16 inch) high riveted or bolted to the equipment.

D. Control Items: All temperature, pressure, and controllers shall be labeled and the component’s function identified. Identify and label each item as they appear on the control diagrams.

E. Valve Tags and Lists:

1. Plumbing: All valves shall be provided with valve tags and listed on a valve list (Fixture stops not included).
2. Valve tags: Engraved black filled numbers and letters not less than 15 mm (1/2 inch) high for number designation, and not less than 8 mm (1/4 inch) for service designation on 19 gauge, 40 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
3. Valve lists: Valve lists shall be created using a word processing program and printed on plastic coated cards. The plastic-coated valve list card(s), sized 215 mm (8-1/2 inches) by 275 mm (11 inches) shall show valve tag number, valve function and area of control for each service or system. The valve list shall be in a punched 3-ring binder notebook. An additional copy of the valve list shall be mounted in picture frames for mounting to a wall. OR shall instruct Contractor where frames shall be mounted.
4. A detailed plan for each floor of the building indicating the location and valve number for each valve shall be provided in the 3-ring binder notebook. Each valve location shall be identified with a color-coded sticker or thumb tack in ceiling or access door.

**2.9 FIRESTOPPING**

A. Section 07 84 00, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for

piping. Refer to Section 22 07 11, PLUMBING INSULATION, for pipe insulation.

**2.10 PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS**

A. In lieu of the paragraph which follows, suspended equipment support and restraints may be designed and installed in accordance with the International Building Code (IBC)// and Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.// Submittals based on the International Building Code (IBC)// and Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS// requirements, or the following paragraphs of this Section shall be stamped and signed by a professional engineer registered in the state where the project is located. The Support system of suspended equipment over 227 kg (500 pounds) shall be submitted for approval of the OR in all cases. See the above specifications for lateral force design requirements.

B. Type Numbers Specified: For materials, design, manufacture, selection, application, and installation refer to MSS SP-58. Refer to Section 05 50 00, METAL FABRICATIONS, for miscellaneous metal support materials and prime coat painting.

C. For Attachment to Concrete Construction:
   1. Concrete insert: Type 18, MSS SP-58.
   2. Self-drilling expansion shields and machine bolt expansion anchors: Permitted in concrete not less than 100 mm (4 inches) thick when approved by the OR for each job condition.
   3. Power-driven fasteners: Permitted in existing concrete or masonry not less than 100 mm (4 inches) thick when approved by the ORORfor each job condition.

D. For Attachment to Steel Construction: MSS SP-58.
   1. Welded attachment: Type 22.
   2. Beam clamps: Types 20, 21, 28 or 29. Type 23 C-clamp may be used for individual copper tubing up to 23 mm (7/8 inch) outside diameter.

E. Hanger Rods: Hot-rolled steel, ASTM A36/A36M or ASTM A575 for allowable load listed in MSS SP-58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn-buckles shall provide 40 mm (1-1/2 inches) minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.

F. Multiple (Trapeze) Hangers: Galvanized, cold formed, lipped steel channel horizontal member, not less than 43 mm by 43 mm (1-5/8 inches

by 1-5/8 inches), 2.7 mm (No. 12 gauge), designed to accept special spring held, hardened steel nuts.

1. Allowable hanger load: Manufacturers rating less 91kg (200 pounds).
2. Guide individual pipes on the horizontal member of every other trapeze hanger with 8 mm (1/4 inch) U-bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 15 mm (1/2 inch) galvanized steel bands, or insulated calcium silicate shield for insulated piping at each hanger.

G. Pipe Hangers and Supports: (MSS SP-58), use hangers sized to encircle insulation on insulated piping. Refer to Section 22 07 11, PLUMBING INSULATION for insulation thickness. To protect insulation, provide Type 39 saddles for roller type supports or insulated calcium silicate shields. Provide Type 40 insulation shield or insulated calcium silicate shield at all other types of supports and hangers including those for insulated piping.

1. General Types (MSS SP-58):
   a. Standard clevis hanger: Type 1; provide locknut.
   b. Riser clamps: Type 8.
   c. Wall brackets: Types 31, 32 or 33.
   d. Roller supports: Type 41, 43, 44 and 46.
   e. Saddle support: Type 36, 37 or 38.
   f. Turnbuckle: Types 13 or 15.
   g. U-bolt clamp: Type 24.
   h. Copper Tube:
      1) Hangers, clamps and other support material in contact with tubing shall be painted with copper colored epoxy paint, copper-coated, plastic coated or taped with isolation tape to prevent electrolysis.
      2) For vertical runs use epoxy painted, copper-coated or plastic coated riser clamps.
      3) For supporting tube to strut: Provide epoxy painted pipe straps for copper tube or plastic inserted vibration isolation clamps.
      4) Insulated Lines: Provide pre-insulated calcium silicate shields sized for copper tube.
   i. Supports for plastic or glass piping: As recommended by the pipe manufacturer with black rubber tape extending 1 inch beyond steel support or clamp.

j. Spring hangers are required on all plumbing system pumps one horsepower and greater.

2. Plumbing Piping (Other Than General Types):
   a. Horizontal piping: Type 1, 5, 7, 9, and 10.
   b. Chrome plated piping: Chrome plated supports.
   c. Hangers and supports in pipe chase: Prefabricated system ABS self-extinguishing material, not subject to electrolytic action, to hold piping, prevent vibration and compensate for all static and operational conditions.
   d. Blocking, stays and bracing: Angle iron or preformed metal channel shapes, 1.3 mm (18 gauge) minimum.

H. Pre-insulated Calcium Silicate Shields:
   1. Provide 360-degree water resistant high density 965 kPa (140 psig) compressive strength calcium silicate shields encased in galvanized metal.
   2. Pre-insulated calcium silicate shields to be installed at the point of support during erection.
   3. Shield thickness shall match the pipe insulation.
   4. The type of shield is selected by the temperature of the pipe, the load it must carry, and the type of support it will be used with.
      a. Shields for supporting cold water shall have insulation that extends a minimum of 25 mm (1 inch) past the sheet metal.
      b. The insulated calcium silicate shield shall support the maximum allowable water filled span as indicated in MSS SP-58. To support the load, the shields shall have one or more of the following features: structural inserts 4138 kPa (600 psig) compressive strength, an extra bottom metal shield, or formed structural steel (ASTM A36/A36M) wear plates welded to the bottom sheet metal jacket.
   5. Shields may be used on steel clevis hanger type supports, trapeze hangers, roller supports or flat surfaces.

I. Seismic Restraint of Piping: Refer to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

**2.11 PIPE PENETRATIONS**

A. Pipe penetration sleeves shall be installed for all pipe other than rectangular blocked out floor openings for risers in mechanical bays.

B. Pipe penetration sleeve materials shall comply with all firestopping requirements for each penetration.

C. To prevent accidental liquid spills from passing to a lower level, provide the following:
   1. For sleeves: Extend sleeve 25 mm (1 inch) above finished floor and provide sealant for watertight joint.
   2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.
   3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.

D. Penetrations are prohibited through beams or ribs, but may be installed in concrete beam flanges, with structural engineer prior approval. Any deviation from these requirements must receive prior approval of OR.

E. Sheet metal, plastic, or moisture resistant fiber sleeves shall be provided for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.

F. Cast iron or zinc coated pipe sleeves shall be provided for pipe passing through exterior walls below grade. The space between the sleeve and pipe shall be made watertight with a modular or link rubber seal. The link seal shall be applied at both ends of the sleeve.

G. Galvanized steel or an alternate black iron pipe with asphalt coating sleeves shall be for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. A galvanized steel sleeve shall be provided for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, sleeves shall be connected with a floor plate.

H. Brass Pipe Sleeves shall be provided for pipe passing through quarry tile, terrazzo or ceramic tile floors. The sleeve shall be connected with a floor plate.

I. Sleeve clearance through floors, walls, partitions, and beam flanges shall be 25 mm (1 inch) greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation plus 25 mm (1 inch) in diameter. Interior openings shall be caulked tight with firestopping material and sealant to prevent the spread of fire, smoke, water and gases.

J. Sealant and Adhesives: Shall be as specified in Section 07 92 00, JOINT SEALANTS. Bio-based materials shall be utilized when possible.

K. Pipe passing through roof shall be installed through a 4.9 kg per square meter copper flashing with an integral skirt or flange. Skirt or flange shall extend not less than 200 mm (8 inches) from the pipe and set in a solid coating of bituminous cement. Extend flashing a minimum of 250 mm (10 inches) up the pipe. Pipe passing through a waterproofing membrane shall be provided with a clamping flange. The annular space between the sleeve and pipe shall be sealed watertight.

**2.12 TOOLS AND LUBRICANTS**

A. Furnish, and turn over to the OR, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.

B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.

C. Tool Containers: metal, permanently identified for intended service and mounted, or located, where directed by the OR.

D. Lubricants: A minimum of 0.95 L (1 quart) of oil, and 0.45 kg (1 pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application. Bio-based materials shall be utilized when possible.

**2.13 WALL, FLOOR AND CEILING PLATES**

A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.

B. Thickness: Not less than 2.4 mm (3/32 inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025 inch) for up to 75 mm (3 inch) pipe, 0.89 mm (0.035 inch) for larger pipe.

C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Wall plates shall be used where insulation ends on exposed water supply pipe drop from overhead. A watertight joint shall be provided in spaces where brass or steel pipe sleeves are specified.

**2.14 ASBESTOS**

A. Materials containing asbestos are prohibited.

**PART 3 - EXECUTION**

**3.1 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING**

A. Location of piping, sleeves, inserts, hangers, and equipment, access provisions shall be coordinated with the work of all trades. Piping, sleeves, inserts, hangers, and equipment shall be located clear of windows, doors, openings, light outlets, and other services and utilities. Equipment layout drawings shall be prepared to coordinate proper location and personnel access of all facilities. The drawings shall be submitted for review.

B. Manufacturer's published recommendations shall be followed for installation methods not otherwise specified.

C. Operating Personnel Access and Observation Provisions: All equipment and systems shall be arranged to provide clear view and easy access, without use of portable ladders, for maintenance, testing and operation of all devices including, but not limited to: all equipment items, valves, backflow preventers, filters, strainers, transmitters, sensors, meters and control devices. All gauges and indicators shall be clearly visible by personnel standing on the floor or on permanent platforms. Maintenance and operating space and access provisions that are shown in the drawings shall not be changed nor reduced.

D. Structural systems necessary for pipe and equipment support shall be coordinated to permit proper installation.

E. Location of pipe sleeves, trenches and chases shall be accurately coordinated with equipment and piping locations.

F. Cutting Holes:

1. Holes shall be located to avoid interference with structural members such as beams or grade beams. Holes shall be laid out in advance and drilling done only after approval by OR. If the Contractor considers it necessary to drill through structural members, this matter shall be referred to OR for approval.
2. Waterproof membrane shall not be penetrated. Pipe floor penetration block outs shall be provided outside the extents of the waterproof membrane.
3. Holes through concrete and masonry shall be cut by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill will not be allowed, except as permitted by OR where working area space is limited.

G. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other services are not shown but must be provided.

H. Protection and Cleaning:

1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the OR. Damaged or defective items in the opinion of the OR, shall be replaced at no additional cost or time to the Owner.
2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Pipe openings, equipment, and plumbing fixtures shall be tightly covered against dirt or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.

I. Concrete and Grout: Concrete and shrink compensating grout 25 MPa (3000 psig) minimum, specified in Section 03 30 00, CAST-IN-PLACE CONCRETE, shall be used for all pad or floor mounted equipment.

J. Gauges, thermometers, valves and other devices shall be installed with due regard for ease in reading or operating and maintaining said devices. Thermometers and gauges shall be located and positioned to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.

K. Interconnection of Controls and Instruments: Electrical interconnection is generally not shown but shall be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, alarms, instruments and computer workstations. Comply with NFPA 70.

L. Domestic cold and hot water systems interface with the HVAC control system for the temperature, pressure and flow monitoring requirements to mitigate legionella. See the HVAC control points list as specified on drawings.

M. Work in Existing Building:

1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the Section 01 00

00, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).

2. As specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will cause the least interfere with normal operation of the facility.

N. Work in Animal Research Areas: Seal all pipe penetrations with silicone sealant to prevent entrance of insects.

O. Work in bathrooms, restrooms, housekeeping closets: All pipe penetrations behind escutcheons shall be sealed with plumbers' putty.

P. Switchgear Drip Protection: Every effort shall be made to eliminate the installation of pipe above data equipment, and electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints. Drain valve shall be provided in low point of casement pipe.

Q. Inaccessible Equipment:

1. Where the Owner determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost or additional time to the Owner.

2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as electrical conduit, motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

**3.2 TEMPORARY PIPING AND EQUIPMENT**

A. Continuity of operation of existing facilities may require temporary installation or relocation of equipment and piping. Temporary equipment or pipe installation or relocation shall be provided to maintain continuity of operation of existing facilities.

B. The Contractor shall provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment shall be properly supported, sloped to drain, operate without excessive stress, and shall be insulated where injury can occur to personnel by contact with operating facilities. The requirements of paragraph 3.1 shall apply.

C. Temporary facilities and piping shall be completely removed back to the nearest active distribution branch or main pipe line and any openings in structures sealed. Dead legs are prohibited in potable water systems. Necessary blind flanges and caps shall be provided to seal open piping remaining in service.

**3.3 RIGGING**

A. Openings in building structures shall be planned to accommodate design scheme.

B. Alternative methods of equipment delivery may be offered and will be considered by Owner under specified restrictions of phasing and service requirements as well as structural integrity of the building.

C. All openings in the building shall be closed when not required for rigging operations to maintain proper environment in the facility for Owner operation and maintenance of service.

D. Contractor shall provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures shall be Contractor's full responsibility.

E. Contractor shall check all clearances, weight limitations and shall provide a rigging plan designed by a Registered Professional Engineer. All modifications to structures, including reinforcement thereof, shall be at Contractor's cost, time and responsibility.

F. Rigging plan and methods shall be referred to OR for evaluation prior to actual work.

**3.4 PIPE AND EQUIPMENT SUPPORTS**

A. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Holes shall be drilled or burned in structural steel ONLY with the prior written approval of the OR.

B. The use of chain pipe supports, wire or strap hangers; wood for blocking, stays and bracing, or hangers suspended from piping above shall not be permitted. Rusty products shall be replaced.

C. Hanger rods shall be used that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. A minimum of 15 mm (1/2 inch) clearance between pipe or piping covering and adjacent work shall be provided.

D. For horizontal and vertical plumbing pipe supports, refer to the International Plumbing Code (IPC) and these specifications.

E. Overhead Supports:

1. The basic structural system of the building is designed to sustain the loads imposed by equipment and piping to be supported overhead.
2. Provide steel structural members, in addition to those shown, of adequate capability to support the imposed loads, located in accordance with the final approved layout of equipment and piping.
3. Tubing and capillary systems shall be supported in channel troughs.

F. Floor Supports:

1. Provide concrete bases, concrete anchor blocks and pedestals, and structural steel systems for support of equipment and piping. Concrete bases and structural systems shall be anchored and doweled to resist forces under operating and seismic conditions (if applicable) without excessive displacement or structural failure.
2. Bases and supports shall not be located and installed until equipment mounted thereon has been approved. Bases shall be sized to match equipment mounted thereon plus 50 mm (2 inch) excess on all edges. Structural drawings shall be reviewed for additional requirements. Bases shall be neatly finished and smoothed, shall have chamfered edges at the top, and shall be suitable for painting.
3. All equipment shall be shimmed, leveled, firmly anchored, and grouted with epoxy grout. Anchor bolts shall be placed in sleeves, anchored to the bases. Fill the annular space between sleeves and bolts with a grout material to permit alignment and realignment.
4. For seismic anchoring, refer to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

**3.5 LUBRICATION**

A. All equipment and devices requiring lubrication shall be lubricated prior to initial operation. All devices and equipment shall be field checked for proper lubrication.

B. All devices and equipment shall be equipped with required lubrication fittings. A minimum of 1 liter (1 quart) of oil and 0.45 kg (1 pound) of grease of manufacturer's recommended grade and type for each different application shall be provided. All materials shall be delivered to OR in unopened containers that are properly identified as to application.

C. A separate grease gun with attachments for applicable fittings shall be provided for each type of grease applied.

D. All lubrication points shall be accessible without disassembling equipment, except to remove access plates.

E. All lubrication points shall be extended to one side of the equipment.

**3.6 PLUMBING SYSTEMS DEMOLITION**

A. Rigging access, other than indicated in the drawings, shall be provided after approval for structural integrity by the OR. Such access shall be provided at no additional cost or time to the Owner. Where work is in an operating plant, approved protection from dust and debris shall be provided at all times for the safety of plant personnel and maintenance of plant operation and environment of the plant.

B. In an operating plant, cleanliness and safety shall be maintained. The plant shall be kept in an operating condition. Owner personnel will be carrying on their normal duties of operating, cleaning and maintaining equipment and plant operation. Work shall be confined to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Dust and debris shall not be permitted to accumulate in the area to the detriment of plant operation. All flame cutting shall be performed to maintain the fire safety integrity of this plant. Adequate fire extinguishing facilities shall be available at all times. All work shall be performed in accordance with recognized fire protection standards including NFPA 51B. Inspections will be made by personnel of the facility, and the Contractor shall follow all directives of the OR with regard to rigging, safety, fire safety, and maintenance of operations.

C. Unless specified otherwise, all piping, wiring, conduit, and other devices associated with the equipment not re-used in the new work shall be completely removed from Owner property per Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT. This includes all concrete equipment pads, pipe, valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. All openings shall be sealed after removal of equipment, pipes, ducts, and other penetrations in roof, walls, floors, in an approved manner and in accordance with plans and specifications where specifically covered. Structural integrity of the building system shall be maintained. Reference shall also be made to the drawings and specifications of the

other disciplines in the project for additional facilities to be demolished or handled.

D. All valves including gate, globe, ball, butterfly and check, all pressure gauges and thermometers with wells shall remain Owner property and shall be removed and delivered to OR and stored as directed. The Contractor shall remove all other material and equipment, devices and demolition debris under these plans and specifications. Such material shall be removed from Owner property expeditiously and shall not be allowed to accumulate. Coordinate with the OR and Infection Control.

E. Asbestos Insulation Removal: Conform to Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT.

**3.7 CLEANING AND PAINTING**

A. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Owner, the plant facilities, equipment and systems shall be thoroughly cleaned and painted. Refer to Section 09 91 00, PAINTING.

B. In addition, the following special conditions apply:

1. Cleaning shall be thorough. Solvents, cleaning materials and methods recommended by the manufacturers shall be used for the specific tasks. All rust shall be removed prior to painting and from surfaces to remain unpainted. Scratches, scuffs, and abrasions shall be repaired prior to applying prime and finish coats.
2. The following Material and Equipment shall NOT be painted:
   a. Motors, controllers, control switches, and safety switches.
   b. Control and interlock devices.
   c. Regulators.
   d. Pressure reducing valves.
   e. Control valves and thermostatic elements.
   f. Lubrication devices and grease fittings.
   g. Copper, brass, aluminum, stainless steel and bronze surfaces.
   h. Valve stems and rotating shafts.
   i. Pressure gauges and thermometers.
   j. Glass.
   k. Name plates.
3. Control and instrument panels shall be cleaned and damaged surfaces repaired. Touch-up painting shall be made with matching paint type and color obtained from manufacturer or computer matched.

4. Pumps, motors, steel and cast-iron bases, and coupling guards shall be cleaned, and shall be touched-up with the same paint type and color as utilized by the pump manufacturer.
5. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats per Section 09 91 00, Painting.
6. The final result shall be a smooth, even-colored, even-textured factory finish on all items. The entire piece of equipment shall be repainted, if necessary, to achieve this. Lead based paints shall not be used.

**3.8 IDENTIFICATION SIGNS**

A. Laminated plastic signs, with engraved lettering not less than 7 mm (3/16 inch) high, shall be provided that designates equipment function, for all equipment, switches, motor controllers, relays, meters, control devices, including automatic control valves. Nomenclature and identification symbols shall correspond to that used in maintenance manual, and in diagrams specified elsewhere. Attach by chain, adhesive, or screws.

B. Factory Built Equipment: Metal plate, securely attached, with name and address of manufacturer, serial number, model number, size, and performance data shall be placed on factory-built equipment.

C. Pipe Identification: Refer to Section 09 91 00, PAINTING.

**3.9 STARTUP AND TEMPORARY OPERATION**

A. Startup of equipment shall be performed as described in the equipment specifications. Vibration within specified tolerance shall be verified prior to extended operation. Temporary use of equipment is specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

**3.10 OPERATING AND PERFORMANCE TESTS**

A. Prior to the final inspection, all required tests shall be performed as specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TESTS and submit the test reports and records to the OR.

B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Owner.

C. When completion of certain work or systems occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then conduct such performance tests and finalize

control settings during the first actual seasonal use of the respective systems following completion of work. Rescheduling of these tests shall be requested in writing to OR for approval.

D. Perform tests as required for commissioning provisions in accordance with Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS and Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

**3.11 OPERATION AND MAINTENANCE MANUALS**

A. All new and temporary equipment and all elements of each assembly shall be included.

B. Data sheet on each device listing model, size, capacity, pressure, speed, horsepower, impeller size, and other information shall be included.

C. Manufacturer’s installation, maintenance, repair, and operation instructions for each device shall be included. Assembly drawings and parts lists shall also be included. A summary of operating precautions and reasons for precautions shall be included in the Operations and Maintenance Manual.

D. Lubrication instructions, type and quantity of lubricant shall be included.

E. Schematic diagrams and wiring diagrams of all control systems corrected to include all field modifications shall be included.

F. Set points of all interlock devices shall be listed.

G. Trouble-shooting guide for the control system troubleshooting shall be inserted into the Operations and Maintenance Manual.

H. The control system sequence of operation corrected with submittal review comments shall be inserted into the Operations and Maintenance Manual.

I. Emergency procedures for shutdown and startup of equipment and systems.

**3.12 COMMISSIONING**

A. Provide commissioning documentation in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

B. Components provided under this section of the specification will be tested as part of a larger system.

**3.13 DEMONSTRATION AND TRAINING**

A. Provide services of manufacturer’s technical representative for 4 hours to instruct the personnel responsible in operation and maintenance of the system.

B. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

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# DIVISION 23 HEATING, VENTILATING & AIR CONDITIONING (HVAC)

# DIVISION 26: ELECTRICAL

**TABLE OF CONTENTS**


| SECTION | TITLE | PAGES |
|---|---|---|
| 260511 | ELECTRICAL WORKS – GENERAL | 10 |
| 260519 | ELECTRICAL WIRES AND CABLES | 5 |
| 260526 | GROUNDING | 5 |
| 260533.13 | ELECTRICAL RACEWAY SYSTEM | 8 |
| 260800 | FIELD ACCEPTANCE TEST | 3 |
| 262726 | WIRING DEVICES | 5 |
| 265100 | LIGHTING | 3 |

**SECTION 260511**

**ELECTRICAL WORK GENERAL**

## PART 1 GENERAL

### 1.01 DESCRIPTION

A. Install electric power, lighting and grounding systems, including the installation and wiring of miscellaneous instruments and devices.

B. Furnish temporary circuits, over current devices, conduit and wiring, and other equipment required during change-over from existing to proposed electric system.

### 1.02 QUALITY ASSURANCE

A. Install electrical work-n conformance with latest rules and requirements of National Fire Protection Association Standard No. 70 (National Electric Code) and with requirements of the Puerto Rico Electric Power Authority.

### 1.03 SUBMITTALS

A. Shop Drawings and Data: Include manufacturer's drawings, bills of material, panel and equipment layouts, catalog data, wiring diagrams and other documentary or descriptive information as required for each assembly submitted in one package insofar as possible.

1. Bills of material: Include a numbered list of all components, with manufacturer's name; catalog number, rating, and other identification. Place item number or similar identification on all other drawings where item appears.

2. Where additions and modifications are made to existing equipment, provide drawings which include both retained existing equipment and new work.

3. Mark shop drawings and data submitted showing only items applicable to specific contract.

4. Make early submission of certain drawings where dimensions of equipment, location of conduit, entrances, etc., are important to facilitate construction.

5. Include one-line diagrams, schematic diagrams and wiring diagrams. Submit only completed drawings showing all local and remote devices associated with each item. Submit one complete package of shop drawings as far as possible. Partial submittals may be returned with but action.

6. Submit list of type and make of conduit, fittings, wires, cables, switches, fixtures, receptacles, pushbuttons, sleeves and inserts, etc.

7. Submit for installation, operation and maintenance of equipment, and parts list. Specifically mark standard publications forming a part of this contract. Cross out, blank out, or otherwise delete any non-applicable items.

8. Install nameplates on all devices or pieces of equipment for which use or identification not readily apparent, such as, starters, relays, contactors, pushbuttons, indicating lights, and switches. Ensure position of nameplates readable after equipment installation.

9. Submit samples of wires and cables.

10. As soon as possible after award of contract, submit all information and data on wires, cables, and other non delivery items proposed. Early submission for review and early ordering are required to avoid delays in completion of work.

## 1.04 INTERFERENCE AND ERRONEOUS LOCATIONS

A. Locations of electrical equipment, devices, outlets and similar items, as indicated, are approximate only. Exact locations determined or accepted during construction.

B. Verify, in field, all data and final locations of work, done under other sections of specifications, required for placing of electrical work.

C. In case of interference with other work or erroneous location with respect to equipment or structures, furnish all labor and materials necessary to complete work.

## 1.05 APPROVAL AND MARKING EQUIPMENT

A. Insure, that devices and materials are listed and/or labeled by Underwriters Laboratories, Inc. wherever standards have been established by that agency.

Where Underwriters Laboratories listing is not available for equipment, submit certified test reports of adequately equipped, recognized, independent testing laboratory, approved by the local inspecting authority, indicating that equipment is in conformance with local code requirements or any other applicable requirements. In lieu of independent tests test reports, written approval of equipment by local electrical inspecting authority will be acceptable.

B. Clearly mark equipment, devices and material with name or trademark of manufacturer and rating in volts and amperes and other pertinent information on a nameplate.

## 1.06 ELECTRIC SERVICE

A. Earth and rock excavation, backfill, concrete masonry, concrete reinforcement, and construction joints required for electrical work: Conform to requirements specified under applicable sections of specifications.

**1.07 POWER SYSTEM STUDY**

A. Obtain from manufacturer of substation a complete system protection coordination study of electrical distribution system with curves of each protective device indicated on common drawing, to verify proper selectivity and protection for all parts of system obtained. Include all calculations, selected equipment and devices, and recommended settings.

**1.08 INCOMING SERVICE**

A. The power company will install connections to transformer primary.

B. Contractor to furnish and install transformer substation, primary cable and conduit, secondary cable and conduit, stress cones, concrete pads, etc.

C. Furnish and install all necessary conduit and wire to service pole, extend conduit up pole for distance of 10 feet, and leave sufficient length of conductors to reach power company's overhead conductors. Connections at pole made by the power company. Perform work at service pole in accordance with power company's requirements.

D. Perform work at transformer substation in accordance with power company's requirements and in manner approved by power company.

**PART 2 PRODUCTS**

**2.01 EMERGENCY GENERATOR AND TRANSFER SWITCH**

A. Description

1. Furnish generator set complete with a fuel (Diesel) tank, automatic transfer switch(es), battery, automatic battery charger, and all the required accessories for normal operation.

2. Unit shall include the following equipment and accessories:

a. Water cooled radiator.

b. One (1) above ground dual wall fuel (Diesel) tank of 5000 gallons capacity with all fuel supply, return and ventilation lines and equipment.

c. One 24 volts, heavy duty battery with rack and cables.

d. Exhaust critical type muffler with steel connections and fittings, including flexible section and rain cap for exhaust.

e. Vibration isolators of the size, number and type required by the plant manufacturer.

f. Screen, baffled, louvered air intake.

g. Ducted, baffled, louvered and screened hot air discharge.

h. Pumps and filters as required.

i. Relays and Contractors as required for remote control from transfer switch.

j. Instruments and control panel including following:

1) Voltmeter and selector switch.
2) Ammeter and selector switch.
3) Wattmeter and selector switch.
4) Frequency meter and selector switch.
5) Running time meter.
6) Field circuit breaker(s).
7) Voltage regulator with a two (2) position (off and automatic) switch.
8) Water temperature gauge.
9) Oil pressure gauge.
10) Automatic shutdown device with indicator lights for:

a) Over cranking protection
b) High water temperature
c) Low oil pressure

11) Start/stop switch
12) Remote start/stop terminals.

k. Automatic transfer switch(es). Rated for operation at 60 Hertz and shall be provided with the required pilot lights on the door and with the following accessories:

1) Selector switch with off-automatic check position
Time delay in transfer to emergency engine start, adjustable from 1/16 to 180 seconds

2) Time delay on restoration to normal power adjustable from 30 second and 10 minutes.

3) Clock exercise to star generator set automatically, it shall operate every week and run the generator set for one (1) hour and then, stop the generator set automatically.

4) All other accessories required for normal operation.

5) Time delay relays and contractors (if so required).

B. Remarks

1. All elbows shall be of the long radius type.

2. The diameter of the exhaust pipe must be increased 1" for each 10 feet of vertical run after the first 10 feet.

3. The Contractor shall leave the tank full of diesel, fuel of the type required for operation of the emergency generator.

4. The Contractor shall make sure that the connections at the diesel fuel tank are tight before proceeding with the final installation of the tank.

5. The Contractor shall be responsible for providing the complete installation of the emergency generator with all its necessary fittings and appurtenances. This shall be done according to the manufacturer's specifications and instructions.

6. The Contractor shall also be responsible for leaving the emergency power generating system in perfect operating conditions.

7. The structural details shown in the electrical drawings for the support of the diesel fuel tank are of a general nature. It corresponds to the Contractor to provide the correct type and size of structural according to the actual dimensions and characteristics of the tank purchase.

8. At end of the project leave the generator diesel tank full.

**2.02 SUBSTATION**

A. Description

1. Tamper-proof transclosure with padlock provision on all doors.

2. Formed by steel sections ganged together with the sections having formed edges to provide rigidity. The unit shall be fabricated from 12 gauge stainless steel sections or 11 gauge galvanized steel sections coated with heavy duty phenix. Require that Puerto Rico Electric Power Authority (P.R.E.P.A.) standards, all transclosure located within one mile from the coast be made of 12 gauge stainless steel.

3. Sheet metal edges shall be exposed to the weather at a minimum angle.

4. Primary and secondary removable doors shall be provided with separate locks.

5. Unit shall be free-standing and rigid when all doors are removed.

6. Effective ventilation openings shall meet the national electrical code (N.E.C.) regulations given in Section 450-45 (B) and (C).

7. Ventilation openings shall be covered with standard expandable wire mesh of a sufficient number and type of installation as to provide tamper-proof ventilation facilities of adequate capacity to cool the transformers and electrical equipment inside the transclosure.

8. Roof shall be designed in a 4-way pitch to provide good water drainage.

9. All rust scales, weld metals fluxs and / or weld splatters shall be removed from all surfaces prior to painting. The primer coat shall be A.R.C. which is a cold galvanized process. The finish paint shall be P.R.E.P.A. standard gray.

10. A minimum of 6 grounding lugs shall be provided #4/0-AWG bare copper cable shall be used to ground all metal frames. in lieu of grounding lugs a continuous copper ground bus of adequate capacity can also be used in order to ground all metal frames as per N.E.C. and P.R.E.P.A. standards.

11. Transclosure shall be P.R.E.P.A. approved type suitable for outdoor installation. This also applies to the equipment inside the transclosure.

12. Transclosure shall be provided with glasstick safety barriers in all doors and access to live parts as per P.R.E.P.A. requirements. The glasstick barriers shall be so installed as to provide clear view of all the equipment components inside the cubicle.

B. Remarks

1. Transclosure dimensions shall be those approved by PREPA due to the code required clearances.

2. Contractor is responsible for verifying with PREPA the availability of the metering equipment to be installed in this project.

3. Contractor is responsible for anchoring the transclosure to the concrete base in an approved manner.

## 2.03 METERING EQUIPMENT

A. Obtain from power company drilling templates, dimensions, and mounting arrangements for metering transformers.

B. Ensure that metering equipment installation is in accordance with requirements of power company by submitting drawings, sketches, catalog information and other appropriate material for power company approval.

## 2.04 CONDUCTORS

A. Unless otherwise indicated all conductors shall be copper.

B. All building conductors shall be THWN/THHN-600V. Insulation

C. Up to #10-AWG use solid conductors, all larger sizes shall be stranded conductors.

D. Conductors Sizing

All conductors shall be #12-AWG except when otherwise indicated in the drawings or as indicated below for 20 AMPS switch conductors sizing.

All 20 AMPS, 120 volts circuit runs shall be as follows for the indicated length of circuit run:

| ***Length of Circuit Runs*** | ***Conductors Size*** |
|---|---|
| Up to 100' | #12 - AWG |
| From 101' up to 200' | #10 - AWG |
| From 201' up to 300' | #8 - AWG |
| From 301' up to 400' | #6 - AWG |

All 20 AMPS, 277 volts circuit runs shall be as follows for the indicated length of circuit run:

| ***Length of Circuit Runs*** | ***Conductors Size*** |
|---|---|
| Up to 200' | #12 - AWG |
| From 201' up to 350' | #10 - AWG |
| From 350' up to 500' | #8 - AWG |

E. Provide a ground conductors in all the conduits.

F. Provide a #12-AWG green jumper between the receptacle grounding screw and the cutlet box grounding screw.

G. Provide a #12-AWG THHN/THWN first wire in all empty conduits.

**2.05 CONDUITS**

A. Unless otherwise indicated all conduits shall be 3/4" in diameter minimum.

B. Unless otherwise indicated in the drawings the following conduit work shall apply:

1. All conduits installed underground shall be PVC SCH. 40.

2. All conduits installed embedded in floor slabs which are in direct contact with the earth, shall be PVC SCH. 40.

3. All conduits installed embedded in walls, ceiling slabs and in floor slabs which are not in direct contact with the earth shall be EMT.

4. All conduits installed in the area between hung ceilings and ceiling slabs or metal decks shall be EMT.

5. All conduits installed exposed in indoor areas shall be EMT.

6. All conduits installed exposed in outdoor areas shall be PVC COATED HEAVY WALL RIGID GALV. STEEL.

7. Final connections to all motors and electrical equipment shall be done with liquidtight flexible steel conduit.

C. All underground conduit couplings shall be watertight.

D. Provide an expansion joint coupling of the required type and size whenever a conduit crosses an expansion joint.

E. Provide plastic conduit dividers in all underground conduits runs. Maximum distance between dividers to be 4'-0".

**2.06 WIRING DEVICES**

A. Unless otherwise indicated, all wiring devices shall be white colored with 302 stainless steel cover plates, except the weatherproof of outlets which shall have their standard gray cover plates.

B. When two or more wiring devices are shown together in adjacent positions and at the same height, they shall be installed in a multiple gang outlet box of the proper size so that only one raised cover plate of the required type and size are used. 120V and 277V outlets must be installed on separate boxes.

C. All dimmers shall be of the slide type.

D. All wiring devices to be specification grade.

**2.07 PANELBOARDS**

A. All panelboards and load centers shall be provided with a factory installed ground bus for connecting to ground all the ground wires or cables entering or leaving the panelboard. The ground bus shall be similar in size and characteristics to the neutral bus. All panelboard shall have a monoflat front and key lock.

B. When two or more panelbaords or cabinets are shown together in adjacent locations, the top of all panelboards or cabinets shall be aligned with the top of the biggest one so that all the tops are at exactly the same height from the finished floor.

C. Contractor must make sure that the entire electrical system has ground continuity.

**2.08 TELEPHONE CABINETS**

A. Telephone terminals cabinet shall be approved equal to Columbia metal, type "PF" with the door hinges, lock and 3/4" plywood backboard cover at the bottom of the cabinet.

**PART 3 EXECUTION**

**3.01 GENERAL**

A. All the electrical installation shall be done in a neat and workmanlike manner, according to the last edition of the national electrical code, the Puerto Rico Electric Power Authority latest standard and the Puerto Rico Telephone Company latest practices.

B. The Contractor shall visit the job site and become acquainted with the existing field. conditions. It shall be the direct responsibility of the Contractor to bring promptly to the attention of the engineer any discrepancies between the existing field conditions and those that were used for design purposes. This shall be done before the Contractor submits his bid, so that the engineer can render a decision on the matter before the bids are received. The submittal of the bid by the Contractor will be held as proof that the Contractor understand thoroughly and completely the Scope of Work involved, has familiarized himself with the existing field conditions, and has included in his bid all the items necessary to perform the electrical work. No allowance will be permitted on this matter after the bids are received.

C. Unless otherwise indicated all outlets shall be flush mounted and shall have their own independent outlet boxes. Minimum size of outlet box to be 4" square and 1 1/2" deep. Exact size of outlet box shall be determined according to the maximum number of conductors in the box per N.E.C. Article 70-Section 6.

D. All indicated heights are from center of box to finished floor.

E. Contractor shall balance all loads.

F. Route of conduits shown in the layout is schematic and intended only to indicate interconnections between outlets. Exact conduit routing shall be determined at the jog site to conform with the structural conditions and shall be subject to the final approval of the architect/engineer.

G. In conduit runs, the numbers of arrows designate the number of circuits in the conduit (one pole in the panelboard per each circuit). The number of lines designate the number of conductors in the conduit, the longer line being a neutral conductor and "1" being the ground conductor.

H. CI in lighting outlet, C1 indicates the circuit number, L1 indicates the luminary L1____ type from the luminary schedule and 1 indicates the switch controlling unit. C3____ in receptacle outlet, C3 indicates the circuit number.

I. It shall be the responsibility of the Contractor to verify the voltage characteristics as the site with the utility company at the time of installation before ordering any primary equipment.

J. All the self-standing and surface mounted electrical equipment as well as the luminaries shall all be braced for seismic shock according to the seismic restraint manual guidelines for mechanical systems. The same applies to all the conduit work. The details and installation methods in said manual shall be modified as required to fit the electrical installation of the project.,

K. For final location of mechanical and medical equipment see corresponding mechanical and architectural drawings. Contractor to relocate electrical rough-in accordingly at no additional cost to Owner.

L. All pedant mounted luminaries shall be installed using stems, 2 stems per each 4' luminary. Stems shall be painted of the color required by the Architect.

M. Normal power and emergency power switch must be installed in separate conduit runs.

## 3.02 REMOVAL AND RELOCATION OF MATERIAL AND EQUIPMENT

A. Carefully dismantle and salvage electrical equipment, switches, fixtures, conduits, cables, wiring, etc. as necessary to carry out proposed changes. Rehabilitate and relocate items of equipment as required and as indicated or specified.

B. Deliver material and equipment not indicated for reuse to Owner for his disposal.

## 3.03 PROTECTION OF ELECTRICAL EQUIPMENT

Protect electrical equipment from the weather, especially from water dripping or splashing upon it, at all times during shipment, storage; and construction. Do not store equipment outdoors. Where equipment is installed or stored in moist areas, such as unheated buildings, etc., provide acceptable means to prevent moisture damage, such as uniformly distributed source of heat to prevent condensation. Protective means, as acceptable by Engineer.

## 3.04 DEFECTIVE OF DAMAGED EQUIPMENT

Thoroughly dry out equipment or material subjected to possible water damage, and put through special dielectric test as directed, without additional compensation.

**END OF SECTION 16050**

## SECTION 260519

## ELECTRIC CONDUCTORS

### PART 1 GENERAL

### 1.01 DESCRIPTION

A. Furnish and install all (conductors wires and cables) necessary for complete electrical systems, as indicated and specified.

### 1.02 REFERENCE STANDARDS

A. NEC: National Electrical Code: National Fire Protection Association, 470 Atlantic Avenue, Boston, MA.

B. U.U. Underwriters Laboratories, Inc., 333 Pfingston Road, Northbook, IL

1. U.L. 44 - Wires and Cables Rubber Insulated

2. U.L. 83 - Wires Thermoplastic Insulated

3. U.L. 854 - Cables, Service Entrance

C. NEMA: National Electrical Mfg's Association, 2101 L Street, N.W. Washington, DC 20037

1. WC 3 - Rubber Insulated Wire & Cable

2. WC 5 - Thermoplastic Insulated Wire & Cable

3. WC 7 - Cross Linked Thermosetting Polyethylene - Insulated Wire & Cable
4. WC 8 - Ethylene-Propylene Rubber Insulated Wire & Cable
5. WC 30 - Color Coding of Wires & Cable

### 1.03 SUBMITTALS

A. Shop drawings and manufacturer's product data in accordance with requirements of Section 01000.

B. Two samples of each type of wire. Samples of necessary length with manufacturer's name and number or type, voltage rating, conductor size, and insulation type on each conductor sample. Color code all control, indicating and metering wiring, and lighting branch-circuit wiring.

**1.04 MANUFACTURER'S COMPLIANCE**

A. Contingent upon products' compliance with specifications.

B. 15 KV CABLE

1. General Electric Company, 1260 Boston Avenue, Bridgeport, CT - Type

2. Rome Cable Division of Alcoa, 1501 Alcoa Building, Pittsburgh, PA - Type XLP

3. Triangle Conduit and Cable Company, Inc., PO Box 711, New Brunswick, NJ - Everene Cable

4. The Anaconda Company, Wire and Cable Division, Greenwich, CT

C. 600V, 480V, 380V, 220V, 208V, 200V, 120V, 115V cable:

1. General Electric Company

2. Rome Cable Division

3. The Rockbestos Company, 550 Nicoll Street, New Haven, CT

D. Control ad metering wire:

1. The Rockbestos Wire and Cable Company, single and multiconductor, 600V control cable.

2. General Electric Company - Vulkene control cable, Type SI.

3. Rome Cable Company - control cable, 600V, Type B, Size 12, 7 strand.

E. Cable fireproofing tape:

1. MAC Products, Inc., 60 Pennsylvania Avenue,
Kearny, NJ

2. Acceptable Equivalent.

**PART 2 PRODUCTS**

**2.01 MATERIALS**

A. Furnish copper conductors. Material and stranding of conductors: Conform to ASTM B 33-80 ASTM B3-80, and to ASTM B 8-77, for the appropriate class. No. 12 Awg minimum wire size unless otherwise noted.

B. Tinned wire used with natural rubber insulation: Conforms to ASTM B 33. Uncoated, soft or annealed copper wire conforming to ASTM B3-80.

C. 15 KV/5 KV Cables: Single-conductor, shielded, grounded cross-linked polyethylene insulated, 90 degrees C., copper conductors. The outer jacket: polyvinylchloride.

D. Wires and cables for maximum 600 volt power circuits: Type XHHW rated RHW with cross-linked polyethylene insulation, Type RHW-75C with rubber or rubberlike insulation and neoprene jacket or ethylene propylene rubber EPR.

E. Wires and Cables for lighting and other 120/240 volt and 120/208 volt circuits: Type THW-75C.

F. Wires and Cables for control, indicating, metering, or alarm circuits: single and multi-conductor control cable, copper conductors, Class B or C stranding. Insulation, 600 volt polyethylene, polyvinylchloride, or E.P.R.

G. Shielded cable for instrumentation wiring: 19 strand copper conductors, size no. 16 AWG. Insulate conductors individually with color coded polyethylene or polyvinylchloride. Twist pairs twisted with varying lay (if more than one pair) and cover with cable tape and copper or aluminum coated mylar shielding tape and tinned copper drain wire. Jacket: polyvinylchloride. Cables: rated 600 volts and 90 degrees C.

## PART 3 EXECUTION

### 3.01 GENERAL INSTALLATION

A. Install wiring in accordance with applicable provisions of National Electrical Code, and as indicated.

B. Wire and cable sizes are indicated however, in no case use smaller cable sizes than required by the National Electrical Code.

C. Unless otherwise indicated, use no conductor smaller than No. 12 AWG.

D. Conductors for branch lighting circuits: Install conductors of sizes that greatest voltage drop between lighting panel and center of load will not exceed 3 percent at rated load.

E. Number and sizes of wires and conduits indicated are guide only and are not necessarily correct numbers and sizes necessary for actual equipment installed. Install as many wires and conduits as required and necessary for complete electrical system, and provide adequately for the equipment actually installed.

F. Install conductors continuous from outlet to outlet and make no splices except within outlet or junction boxes.

G. Draw all conductors contained within single conduit at same time.

H. Apply wire pulling compound if required to conductors being drawn through conduits. Use pulling compound, Minerallac No. 100, Y-er-Eas, Yellow 77 or acceptable equivalent.

I. Use no cable bend with radius of less than eight times its diameter.

J. Wires and cables installed without prior submittal review and approval are subject to removal at no additional expense to owner.

K. Support cables in rise conducts at intervals as required by National Electrical Code.

**3.02 15 KV AND 5 KV CABLE SPLICING AND TERMINATIONS**

A. Use primary 15KV/5KV cable terminations with rating of 15,000 volts/5,000 volt. Ensure that standard withstand conforms to IEEE Std. 48 and is in compliance with specification Section 16999, Field Acceptance Tests. Use potheads, elbow connectors, clamp type connectors or termination as recommended by equipment manufacturer.

B. Ensure that all splicing and terminating of 15 KV and 5 KV cable is in accordance with designs, materials, and instructions set forth by cable manufacturer.

C. Wrap cables in manholes with fireproof tape which meets ASTM D626. Install tape in accordance with manufacturer's instructions.

**3.03 CONDUCTOR IDENTIFICATION**

A. Lable each wire at both termination points. Carry individual conductor or circuit identification throughout, with circuit numbers or other identification clearly stamped on terminal boards and printed on directory cards in distribution cabinets and panelboards.

B. Identify each wire in junction boxes, cabinets, and terminal boxes where total number of control, indicating, and metering wires is three or more and no terminal boards is provided, including all power wire by means of plastic-coated, self-adhesive, wire marker.

C. In cases similar to above where terminal boards are provided for the control, indicating, and metering wires, identify all wires including motor leads and other power wires too large for connection to terminal boards, by wire markers as specified above.

D. In manholes, identify each wire by laminated plastic tag located so easily seen.

**3.04 CONNECTORS, TERMINAL LUGS AND BOARDS**

A. For wiring of circuits consisting of No. 10 or No. 12 AWG solid wires, such as for lighting branch circuits, utilize self-insulated pressure type connectors for all splices or joints.

B. Terminate all wires connected to terminal boards, terminal blocks, or to other similar terminals by means of ring and tongue, nylon self-insulated, tin-plated copper pressure terminals.

C. Fabricated terminal boards, installed where indicated, of type 600 volts, 30 amperes, screw terminals, with white marking strips for wire identification, of the 4-, 6-, 8-12 pole type, as necessary.

D. Clearly and permanently mark terminal strips with ink or indelible pencil. Mark each wire consistently throughout entire system, using notation of wires given on manufacturer's wiring diagrams wherever possible.

**END OF SECTION 260519**

# SECTION 26 05 26

# GROUNDING

## PART 1 GENERAL

### 1.01 DESCRIPTION

A. Furnish and install a single, complete, integrated grounding system, including all conductors, raceways, and connections, specified and indicated.

B. Include grounding of switchgear, substations, motor control centers, electric equipment enclosures, etc., outdoor substations, transformers, switch structures, etc.; ground grid systems with ground rod and water pipe connections; structural steel, and lightning protection system.

C. Include grounding conductors completely interconnecting water supply pipe, ground rods, ground grid, substation, switchgear and motor control center ground buses, other distribution equipment, and other groundable equipment.

### 1.02 REQUIREMENTS OF REGULATORY AGENCIES

A. Install complete grounding system in accordance with codes, and standards.

### 1.03 REFERENCE STANDARDS

A. American National Standards Institute:

1. ANSI C2.-1978 National Electrical Safety Code

B. National Fire Protection Association, 470 Atlantic Avenue, Boston, MA:

1. NFPA 70-1981 National Electric Code

2. NFPA 78-1975 Lightning Protection Code

### 1.04 TESTS

A. Measure ground grid resistance with earth test megohmeter and install additional ground rods and conductors as required until resistance to interconnected ground system is 5 ohms or less. Measure ground resistance in normally dry conditions and not less than 48 hours after rainfall.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS ACCEPTABLE

A. Contingent upon products' compliance with the specifications.

B. Ground rods - Copperweld Corporation, 2 Oliver Plaza, Pittsburgh, PA.

### 2.02 CONDUCTORS

A. Furnish soft drawn stranded copper grounding conductors. Minimum size of unenclosed grounding conductor shall be No. 6 Awg. All conductors shall be protected if physical damage would result from exposure.

B. Furnish bare conductors where buried in earth or where embedded in concrete.

C. In buildings run insulated grounding conductors with green insulation only.

D. Furnish insulated grounding conductors with insulation rated at 600 volts.

E. Furnish grounding conductors for installation in all non-metallic raceway in addition to, and not to be considered as, the neutral wire of the system.

F. Connect a grounding conductor between panelboard and grounding system. Where a grounding bar is furnished with panelboard, connect grounding conductor to bar.

### 2.03 GROUND BUS

A. Furnish a 2-in. by 1/4-in. copper bar complete with bolted type connectors as indicated. Connect grounding conductors from equipment in area to this ground bus. Connect ground bus to grounding system. Mount ground bus on 600-V. pedestal insulators:

### 2.04 CONNECTIONS

A. Make all buried and concealed ground connections by exothermic welding.

B. Make accessible connections to structural members by exothermic welding process or by bolted connector. Connections to equipment or ground bus by acceptable bolted connectors. Furnish bolted ground connectors suitable for, and matching, grounding provisions furnished.

C. Furnish copper, brass, or silicon bronze ground lamps for use on copper or bass pipes.

D. Furnish ground clamps, for use on iron pipes, of galvanized or malleable iron, or of standard noncorrosive material.

E. Furnish ground clamps for use on pipes, with rigid metal base providing good contact by proper seating on the pipe. Do not use strap type clamps.

F. Design cable to ground rod connectors capable of being installed without having to pass over end of ground rod.

G. Where conduits are not effectively grounded by firm contact with a grounded enclosure, apply grounding bushings on at least one end of conduit run.

H. Furnish copper-clad steel or galvanized steel ground rods; type, diameter and length as indicated on drawings.

## PART 3 EXECUTION

### 3.01 INSTALLATION OF GROUNDING CONDUCTORS

A. Install grounding conductors so not exposed to physical damage. Install connections firm and tight. Arrange conductors and connectors so no strain on connections.

B. Run grounding conductors associated with direct burial cables in common trenches above or if indicated beside cables.

C. Bury equipment grounding conductors 18-in. deep. Bring loops or taps up for connection to equipment or other items to be grounded.

D. Where raceways are used to contain and protect grounding conductors, install in accordance with Electrical Raceway Systems Section.

E. Where bare grounding conductors are contained within metallic raceways, bond ends of raceways to conductors by suitable fittings.

F. Install loop type, low impedance, grounding system interconnecting all components so at least two grounding connections are provided for each major item of electrical equipment. Ensure that severing of any single grounding conductor in this system does not remove grounding protection on any major item.

G. Connect structural steel at locations indicated by an external perimeter loop of grounding conductor installed around all sides of building foundation, buried at least 18-in. (450 mm) below grade, and connect to each vertical column by loop or tap. Connect two opposite points on external loop to two different points on grounding system.

H. Perform exothermic welding with properly sized molds in good condition.

### 3.02 INSTALLATION OF GROUND RODS

A. Install ground rods in manholes in accordance with requirements specified under the Section Underground Distribution Systems. Connect each grounding conductor entering a manhole to ground rod.

B. Install ground rods where indicated. Install the top of the rod 12-in. below the ground surface. Measure ground resistance of electric power service ground rod and if it is not 25 ohms or less, drive additional rods to obtain resistance of 25 ohms or less.

C. Make connection to overall grounding system as indicated.

D. Ensure that final resistance of interconnected ground system is 5 ohms, or less. Measure ground resistance in normally dry conditions, and not less than 48 hours after rainfall.

**3.03 EQUIPMENT GROUNDING**

A. Ground each piece of electrical equipment by means of a grounding conductor installed in raceway feeding that piece of equipment with copper wire sized in accordance with National Electric Code. Grounding conductors installed in conduit furnished with green, 600-volt insulation.

B. Connect transformer cases and neutrals to grounding system. Connect neutral ground connection at transformer terminal. Provide two separate, independent, diagonally opposite, connections for power transformers so removal of one connection will not impair continuity of other.

C. Connect two separate ground connections from ground grid to ground bus of switchgear assemblies, motor control center and all outdoor substation equipment. Ensure that each connection for item of equipment is from different section of ground grid.

D. Install a separate grounding conductor from ground system to motors of 100 hp. and larger, in addition to raceway system. Ground motor ground connection to motor frame, independent of mounting bolts or sliding base. Ground motor to nearest point on grounding system unless otherwise indicated.

E. Connect lightning arresters to ground system by suitable conductors.

F. Connect emergency generator neutral to grounding system by a grounding conductor of size required by National Electrical Code, unless a larger size is indicated. Connect grounding conductor to generator disconnect enclosure and generator neutral on generator side of disconnect. Ground generator frame with two separate independent connections, so removal of one connection will not impair continuity of other.

G. Ground each street lighting standard by ground rod driven near base of standard, in accordance with requirements of National Electric Safety Code. Connect ground rods to grounding conductor brought with street lighting feeder cable.

H. Ground transformers, lightning arresters, insulators etc., installed on poles, poles and timber structures on metal structure. Run grounding conductors between poles or structure and ground rods. Protect grounding conductor by molding applied for at least 8 ft. above ground, with both molding and conductor stapled. Install ground rod where indicated, and driven until top of rod is 1 ft. below ground. Measure ground resistance of rod and if not 25 ohms or less, drive additional rods to obtain resistance of 25 ohms or less.

I. Ground wire fences when used to enclose electrical equipment. Unless otherwise indicated, provide minimal grounding by buried outside peripheral ground loop; connections to each corner fence post and nearby ground rod; flexible connections to

each gate; and at least two connections to grounding system from approximately opposite positions on fence.

J. Also connect the ground rods to the grounding conductor run with the direct burial cable.

**3.04 COMMERCIAL GROUNDING**

A. Telephone:

1. Install one No. 2 insulated ground conductor to ground bus in telephone equipment cabinet.

2. Connect one No.12 insulated ground conductor to all 68 conduits terminating at backboard.

**END OF SECTION 26 05 26**

**SECTION 26 05 33.13**

**ELECTRICAL RACEWAY SYSTEMS**

## PART 1 GENERAL

### 1.01 DESCRIPTION

A. Furnish and install complete raceway systems, with all accessories, fittings, boxes, etc., as indicated and specified.

B. All raceway runs are shown diagrammatically to outline general routing of raceway. Avoid interfering with pipes, ducts, structural members, or other equipment. Deviations in accordance with Engineer, after acceptance, and without additional compensation.

### 1.02 REFERENCE STANDARDS

A. NEC: National Electrical Code: National Fire Protection Association, 470 Atlantic Avenue, Boston, MA.

B. UL: Underwriters' Laboratories, Inc., 333 Pfingsten Road, Northbrook, IL 60062, USA.

C. ANSI: American National Standards Institute, Inc., 1430 Broadway, NY , N.Y. 10018 USA.

D. NEMA: National Electrical Manufacturers Association, 2102 L Street, Northwest, Washington, D.C.

### 1.03 SUBMITTALS

A. Submit shop drawings and manufacturer's product data in accordance with requirements of General Specifications.

## PART 2 PRODUCTS

### 2.01 MANUFACTURER'S COMPLIANCE

A. Manufacturers acceptance contingent upon products' compliance with specifications.

B. Rigid Metal Conduit:

1. Triangle Conduit & Cable Company, 6900 Jersey Ave., New Brunswick, NJ 08903, USA.

2. Republic Steel Corporation. 144: 1-T Republic Building, Cleveland, OH 44101, USA.

3. Robroy Industries, River Road, Verona, PA 15147, USA.

C. Polyvinylchloride (PVC) Conduit:

1. Triangle Conduit & Cable Company, New Brunswick, NJ, USA.
2. Republic Steel Corporation, Cleveland, OH, U.S.A.

3. Carlon Inc., Cleveland, OH USA.

D. Flexible Conduit:

1. American Flexible Conduit Company, P.O. Box A -2094, New Bedford, MA 02741, USA.

2. Anaconda Metal Hose, Brass Division, 700 South Main Street, Waterbury, CT 06723, USA.

3. International Metal Hose Company, Goodrich Road & Sullivan Avenue, Bellevue, OH 44811, USA.

**2.01 MATERIALS AND COMPONENTS**

A. Rigid Metal Conduit:

1. Furnish galvanized rigid metal conduit with a coupling on one end and thread protector on other.

2. Hot-dip galvanize rigid steel conduit over entire length, including threads. Conduit conforming to ANSI Standard C80.1-1966.

B. Flexible-Metal Conduit:

1. Match flexible-metal conduit, fittings, size, and material to rigid conduit to which it is connected, unless otherwise indicated.

2. Liquid-tight flexible-metal conduit consists of flexible, corrosion-resistant metal conduit, with watertight synthetic jacket extruded over the conduit and a continuous copper ground under the jacket. Where ground is not included as in sizes greater than 1-1/4". IPS furnish separate external ground wire. Liquid-tight flexible-metal conduit conforming to UL Standard 360.

C. Polyvinylchloride (PVC) Conduit:

1. Furnish PVC conduit, EPC-40-PVC, for direct burial or exposed in extra severe conditions conforming to industry NEMA Standard TC 2-1975 and UL listed for indicated application.

2. Furnish PVC conduit, EPC-40-PVC, for normal exposed conditions in ductwork, or for use in all corrosive atmospheres specifically chlorine, conforming to industry NEMA Standard TC 2-1975 and UL listed for the indicated application.

D. Polyvinylchloride-Coated Rigid Steel Conduit:

1. Polyvinylchloride-coated (PVC-coated), rigid steel conduit shall be hot-dipped galvanized rigid steel conduit, as specified hereinbefore, with a polyvinylchloride jacket not less than 40 mils thick, bonded to the conduit. The adhesive strength of the bonding shall be equal to or greater than the tensile strength of the coating. Couplings and fittings for this conduit shall include an integral, bonded overlapping pressure-sealing sleeve of the same insulation thickness. The sleeves shall extend one pipe-diameter or 2" (whichever is less) beyond the end of the coupling. When coupled together, the sleeve of the coupling shall make a watertight fit with the plastic jacket on the conduit.

E. Boxes:

1. Furnish standard, sheet-metal, outlet and junction boxes constructed of code-gauge" galvanized sheet steel. Size each box as required by the NEC.

2. Furnish boxes containing fixture studs for hanging fixtures. Furnish concrete-tight boxes for installation in concrete. Do not use shallow boxes unless building construction is such that it is impossible to use standard-depth boxes.

3. Outlet boxes and fittings for hazardous locations conforming to ANSI -Standard C33.27 for class, group, and division indicated.

4. All cast-iron boxes shall be manufactured by O.Z. Electrical MFG. Co., Brooklyn, NY; Appleton Electric Co., Chicago, IL; Crouse-Hinds Co., Syracuse, NY; or be an acceptable equivalent product.

5. All cast-aluminum boxes shall be manufactured by Crouse-Hinds Co., Syracuse, NY; Killark Electric Manufacturing Co., St. Louis, MO; Adalet MFG. Co., Cleveland, OH; or be an acceptable equivalent product.

6. Boxes and covers for use with polyvinylchloride coated steel conduit shall be galvanized cast boxes as above, with a polyvinylchloride factory-applied coating over the galvanizing. The coating shall have a 40-mil thickness and the boxes shall have hubs with extruded sleeves extending beyond the hub in the same manner as specified for conduit couplings. Cover screws shall be stainless steel.

7. Cast boxes shall be provided with cast covers and watertight gaskets. Cover screws shall be stainless steel or high brass for iron boxes, and stainless steel for aluminum boxes.

8. Polyvinylchloride boxes shall be used with polyvinylchloride conduit. The size of each box shall not be less than that which is required by the National Electrical Code. Boxes shall be manufactured by Carlon, Cleveland, OH; Crouse-Hinds Co., Syracuse, NY; Raco, Inc., South Bend, IN; or be an acceptable equivalent product.

9. Pull boxes used below motor control centers shall be constructed of angle or channel frames, and sheet metal with weld joints. All welds shall be ground smooth. Neoprene gaskets shall be provided for complete sealing. Covers longer than 40" shall be sectionalized to facilitate handling. Sectionalized covers shall be gasketed where covers meet, using angle iron or channel cross, members at the joint. Sheet metal shall be not less than No.12 gage galvanized sheet steel. Interior angles and supports shall be made of galvanized steel, or shall have a corrosion-resistant phosphate coating and primer. Each box shall be provided with a grounding lug for connection to the nearest ground bus. The ground lug shall have the current capacity required by the National Electrical Code for the largest feeder entering the equipment.

F. Fittings:

1. Furnish cast-iron fittings of malleable iron or a mixture of gray iron and cast steel. Conduit fittings shall conform to ANSI Standard C80.4.

2. Supply fittings for electrical metallic tubing with UL Label. Do not use "sock" or "drive-on" fittings. Use fittings of set screw, compression, or permanent indentation types, which are galvanized and made of steel or malleable iron. Where indicated, use fittings which are watertight, with a sealing compression ring.

3. Furnish suitable expansion fittings where conduits cross expansion joints. Equip these fittings with grounding straps, clamps, and copper bonding jumpers.
4. Terminate ends of all floor conduits installed for future use with couplings and readily removable plugs set flush with finished floor surface. Cap spare wall conduits at wall where they enter building.

5. Equip ends of all conduits with suitable conduit fittings. Fit conduit terminating at motor control center or power distribution equipment, or in box above or below, with grounding type bushings, or solidly ground by locknuts or other acceptable fittings. Connect each grounding bushing to ground bus by a bare or green-covered copper wire. Do not use ground wire or smaller than 12 awg. Install sizes larger than 12 gauge as required by NEC. Where conduits terminate in unprotected areas or where bonding is required over expansion joint, flexible conduit or equivalent; ground wire smaller than No. 6 Awg. copper.

6. Terminate conduits entering gasketed sheet-metal boxes or gasketed sheet-metal equipment enclosures with gasketed hubs.

7. Terminate conduits entering non-gasketed sheet-metal boxes or enclosures with double locknuts and insulated bushings, or with acceptable equivalent.

## PART 3 EXECUTION

### 3.01 INSTALLATION OF FITTINGS

A. Install expansion fittings wherever conduits cross structural expansion joints. Keep the fittings in line with conduit, and install with regard to temperature so that full working range of expansion is available.

B. Do not install fittings to replace elbows and pull boxes, unless space or other problems make use of fittings necessary. Use oversize fittings whenever large cable is installed, in order to maintain proper bending radius.

### 3.02 INSTALLATION OF RACEWAYS

A. Install exposed raceways parallel or at right angles to walls and ceiling beams Make all changes in directions as far as possible, with approved bends, elbows, and pull boxes. Space parallel runs uniformly throughout. Secure in place by approved hangers and approved fasteners. Effectively ground by connection to properly grounded enclosures, bonding, or other approved means, to obtain permanent low resistance path to ground throughout installation. Ensure that raceway sections in single run and in parallel runs are of same type and finish.

B. Support raceways concealed above suspended ceilings from slab above ceiling in same manner as exposed raceways. Do not support raceways from ceiling supports.

C. Use cast-in-place inserts in concrete to support-all runs, unless otherwise permitted. Use stainless steel sleeve type concrete anchors for installing boxes, conduit supports, etc. Furnish stainless steel nut, bolts, washers, etc. used with concrete-anchors.

D. Use bolts or machine screws on steel work. Support conduits by hangers or pipe straps spaced according to NEC, but in no case more than 10 feet on centers.

E. Use galvanized supports for galvanized conduit.

F. Install conduits in slabs as close to middle of concrete slabs as practicable without disturbing reinforcement. Do not use conduit with outside diameter exceeding one- third of slab thickness. Do not place conduits closer than three diameters on centers, except at cabinet locations where slab thickness is increased as permitted by Engineer.

G. Where conduits are concealed in bottom floor slab, place in concrete slab and not in fill below slab. Do not install aluminum conduit in concrete slab.

H. Use sleeves passing through exterior walls and slabs which are wall entrance seals of watertight construction. Furnish watertight seal between slab and sleeve, and between

sleeve and conduit and cable. Use wall-entrance seals of malleable iron with watertight sealing gland which may be tightened any time after installation.

I. Do not use dissimilar metals in conjunction with each other. Use suitable insulation between adjoining surfaces so as to eliminate direct contact and any resultant electrolysis. Maintain electrical continuity of system. Use bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators or washers, or other acceptable materials as insulation.

J. Install fittings to match raceway being used.

**3.03 BENDS**

A. Make all bends carefully to prevent distortion of circular cross section. Field bend conduit to have an inside radius of not less than nine diameters.

B. Where bends of less than nine diameters are necessary, use standard factory elbows. Size conduit to permit cable-bending radius within the factory elbow of at least eight times cable diameter.

C. Use concentric bends in parallel runs. Allow no conduit to have more than two 90 degree bends or equivalent thereof between pulling points.

**3.04 CUTTING, THREADING AND CONNECTING**

A. Make all field cuts in raceways squarely, file cut ends, and remove burrs, and chamfer inside edge with conduit reamer. Install insulating bushing on each end of conduit or tubing, unless connector is designed to prevent contact with cut end. Make all connections mechanically strong and tight, and with acceptable connectors. Permit no running threads. Where surface coating is damaged or removed by cutting, threading or reaming restore to original condition.

**3.05 CONDUIT CLEANING**

A. Clean all conduit carefully before and after installation, ream ends free of burrs, and free inside surfaces from all imperfections likely to injure cable.

B. After installation of each complete new conduit run, snake the run with band to which is attached an acceptable tube cleaner with acceptable cylindrical mandrel of a diameter not less than, 85 percent of nominal diameter of conduit. Remove and replace all conduit through which mandrel will not pass.

C. Use a steel band and mandrel to clean steel conduit.

D. After cleaning, protect ends of all conduit with standard caps to prevent entrance of water, concrete, debris, or other foreign substance.

**3.06 CONDUIT DRAINAGE**

A. As far as practicable, pitch conduit to drain to outlet boxes, or install so as to avoid trapping moisture. Where dips are unavoidable in exposed conduits, install fitting with suitable drain hole at low point.

**3.07 INSTALLATION OF BOXES**

A. Install sheet metal boxes only in dry, accessible location. Do not install below grade, in outside concrete or masonry walls or in floor slabs subject to moisture. Sheet metal boxes cannot be used where vapor-tight fixtures are required for surface mounting of wall switches and receptacles or for any outdoor use.

B. Install boxes in conformity with all requirements of NEC. Install boxes designed for type of construction involved. Support boxes in same manner as required for conduit. Size boxes to provide bending radius for wire or cable of at least eight times diameter or in accordance with NEC, whichever is larger.

C. Center all outlets in panels, or spaces and adjust to structural finish. Where specific locations are not indicated, locate outlets with respect to equipment served.

D. Place all outlet boxes, junction boxes, pull boxes, etc., in accessible locations when they are installed above or behind plastered ceilings, furred spaces, or suspended ceilings. Install access panels of suitable size. Mark all access panels for all boxes so panels can be readily located in future. Mark, using metal tabs or plastic buttons which cannot mark ceilings or walls, appropriate for type of construction being used.

E. Assemble cast-metal boxes with threaded conduit hubs in such manner that conduit connections and gasketed covers are watertight. Close all unused threaded openings with pipe plugs and compound.

F. Provide cast boxes with cast covers and watertight gaskets. Install cover screws of stainless steel or high brass for iron boxes, and stainless steel for aluminum boxes.

**3.08 MOTOR AND EQUIPMENT CONNECTIONS**

A. At all motors and other electrically operated equipment to which conduit connections are required install complete connection between end of conduit and terminal box of motor or other equipment.

B. Terminate conduits extending up through floors in locations permitting direct connection to motors.

C. Make connections with flexible metal conduit.

D. Install flexible metal conduit, fittings, and accessories in accordance with requirements of NEC. Use flexible metal conduit only for connections to motors, or to other equipment

subject to vibration or adjustment. Make each connection with at least one quarter bend so that no vibration can be transmitted beyond flexible connection. Install visible bonding wire across flexible connection larger than 1-1/4-in. IPS size bonding wire in accordance with NEC; but in no case smaller than 6 awg. stranded.

E. Install liquid-tight flexible metal conduit, mechanically strong and watertight, and located to reduce possibility of damage to exterior coating. Use connectors that screw into flexible conduit and provide gaskets where needed.

## 3.09 HAZARDOUS AREAS

A. Install all conduits, fittings, equipment and devices within areas indicated to comply wit requirements of NEC for Hazardous Locations, Class, Division, and Group as indicated.

B. In such hazardous locations, seal conduits terminating at boxes enclosing circuit-opening equipment at entrance to enclosure with approved, compound-filled, commercial, sealing fittings to prevent passage of explosive or combustible gases through conduits.

C. Seal all conduits leading from or entering such hazardous locations at points of exit or entrance.

D. Install conduit connections with at least five threads tightly engaged, and made up with suitable thread compound.

**END OF SECTION 16110**

# SECTION 26 08 00

# FIELD ACCEPTANCE TESTS

## PART 1 GENERAL

### 1.01 DESCRIPTION

A. After electrical installation is complete, make tests to demonstrate that entire system is in proper working order and in accordance with drawings and specifications. Make no tests less than those outlined hereafter, unless requested in writing and approved by Program Manager. Tests are in addition to, and no substitution for, tests of individual items at manufacturer's plant. Make insulation and ground resistance tests before operating tests. Determine proper rotation of motors before permanent connections are made.

B. Pay all costs for tests including expenses incident to retests occasioned by defects and failures of equipment to meet specifications.

1. Replace wiring and equipment found defective, or failing to meet specified requirements, without charge.

2. Furnish three copies of all test results to Engineer.

3. Unless otherwise specified Owner will supply electric current necessary for tests.

### 1.02 REFERENCE STANDARDS

A. NEMA: National Electrical Manufacturers Association, 2101L Street, Northwest, Washington, D.C.

B. IEEE: Institute of Electrical and Electronic Engineers, 345 East 47th Street, New York, NY.

## PART 2 PRODUCTS

### 2.01 TESTING EQUIPMENT

A. Calibration:

1. Furnish suitable electrical instruments including voltmeters, ammeters, wattmeters, tachometers and all other equipment necessary to perform tests specified. Furnish certified copies of calibration curves of these instruments which have been calibrated for specific tests.

2. Make necessary openings in circuits for testing instruments and place and connect all instruments, equipment, and devices, necessary for the tests. Upon completion of tests, remove instruments and instrument connections and restore all circuits to permanent condition.

3. Other sections of specifications require services of one or –more manufacturer's representatives, to ensure that equipment supplied has been installed properly and adjusted to proper working order. Advise representative of all applicable tests in this section, so that work will be coordinated, and tests combined where feasible.

**2.02 TESTING**

A. Coordination:

1. Coordinate activities, and cooperate with others on project to ensure that systems are energized when required, loads applied, and other requirements of Section are carried out on timely coordinated basis.

2. Conduct tests in presence of Engineer. Notify Engineer seven calendar days or more in advance when any test to be performed, and do not start tests without Engineer's permission.

B. Preparation:

1. Make up no high and/or medium-voltage connections at service entrance, transformers, substations, motors, medium voltage motor control centers, switchgear and generator permanently until correct phase rotation of all equipment is determined.

Install and insulate these connections temporarily, if necessary, while determining proper rotation. Have permanent connections after proper rotation has been established and subsequent to completion of insulation resistance and dielectric tests.

**PART 3 INSULATION**

**3.01 INSULATION RESISTANCE TESTS OF CIRCUITS, 600 VOLTS AND BELOW**

A. Do not subject conductors rated 600 volts and below to high potential dielectric tests. Test each complete feeder and branch circuit of 6000 volts or below with everything but power supply and power-consuming equipment, connected thereto, and have an insulation resistance, between conductors and between each conductor and ground of not less than 1,000,000 ohms, unless otherwise accepted y Engineer.

B. Determine insulation resistance values with all switchboards, panelboards, fuseholders, switches, receptacles, and overcurrent devices in place.

C. Use megohmeter having output of at least 500 volts to determine insulation resistance value for 600 volt rated conductors, and a 2400 volt megohmeter for 5 KV and 15 KV rated conductors.

D. List each circuit and measured resistance as test data.

E. Maintain record of all insulation resistance valued. Identify conductor, or equipment, date that value was taken and resistance value. Arrange information in suitable neat tabular form and turn to Engineer in triplicate

**3.02 DIELECTRIC TESTS OF CONDUCTORS RATED 2400 VOLTS AND ABOVE**

A. After all high and/or medium-voltage conductors are installed, and before connecting and putting into service, subject to dielectric tests. Perform direct current, high-potential tests form phase to phase and from phase to ground. Make tests as specified in latest edition of the applicable IPCEA-NEMA Standard.

B. Complete and enclose splices in conductor system being tested within all pull, junction or splice boxes before test is started, and complete all potheads and switchgear terminations. Disconnect potential transformers and all power consuming equipment or devices from circuit, if any are present.

**3.03 GROUND RESISTANCE**

A. Test each ground rod in accordance with IEEE Std. 142, and submit tabulation of results. Include identification of electrode, date of reading and ground resistance value in results.

B. Test each entire grounding system for continuity of connections and for resistance. Ensure that ground resistance of conduits, equipment cases, and supporting frames does not vary appreciably from that of system as whole and does not exceed 5 Ohms.

**END OF SECTION 26 08 00**

# SECTION 26 27 26

# WIRING DEVICES

## PART 1 GENERAL

### 1.01 DESCRIPTION

A. Furnish, install, field test, and place in successful operating condition, wiring devices as indicated and as specified.

### 1.02 REFERENCE STANDARDS

A. NEMA: National Electrical Manufacturers Association, 2102 L Street Northwest, Washington, D.C.

B. Federal Specifications, Superintendent of Documents, U.S. Government Printing Office Washington, D.C. 20402.

1. W-S-896c(1) Switch, Toggle, Single Unit with wall plates.

2. W-C-596,b(1) Plug, Electrical Connector, Receptacle, Electrical.

C. Underwriters' Laboratories, Incorporated Standards.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Arrow-Hart, Inc., Florence, KY.

B. Allen-Bradley Co., Milwaukee; WI.

C. Appleton Electric Co., Chicago, IL.

D. Bryant Electric, Div. of Westinghouse, Bridgeport, CT.

E. Cutler Hammer, Inc., Milwaukee, WI.

F. Crouse-Hinds Co., Syracuse, NY.

G. Harvey Hubbell, Inc., Bridgeport, CT.

H. Midland-Ross Corp., - Electrical Products Div., Pittsburgh, PA.

I. Sierra Electric, Div. of Sola Basic, inc. Gardena, CA.

## 2.02 WALL SWITCHES

A. Provide alternating current, general-use, snap switches, in flush device boxes or on outlet box covers, totally enclosed in composition case, with insulated mounting yoke and sidewired, binding screw type terminals. Single-pole, 2-pole, 3-way, or 4-way switches rated 20 amperes at 120/277 volts a.c.

B. Switches for controlling lighting:

1. Arrow-Hart Cat. No. 1991, 1992 or 1994
2. Harvey Hubbell Cat. No. 1221, 1222, 1223 or 1224
3. Bryant Electric Cat. No. 4901, 4902, 4903 or 4904
4. Sierra Electric Cat. No. 5721X, 5722X, 5723X or 5724X

C. Provide pilot lights for switches controlling lights in seldom frequented locations Consisting of either separate units or a 2-unit combination with separate switch and yoke-mounted candelabra base socket rated 75 watts, 125 volts, and fitted with a ruby lens. Provide a clear 6 or 7-watt lamp with each pilot.

## 2.03 WATERTIGHT SWITCHES

A. Provide watertight switches consisting of flush mounting switches in NEMA Type 4 gasketed cast metal boxes. Switch operable through shaft in matching cast metal cover, twenty-ampere, 120/277-volt switch enclosures:

1. Crouse-Hinds Type MC or MCC
2. Allen-Bradley Cat. No. 600-TCX-4
3. Cutler-Hammer Cat. No. 91-1 H 96

## 2.04 EXPLOSIONPROOF SWITCHES

A. Provide explosionproof switches consisting of flush mounting switches in cast metal boxes meeting requirements for NEMA Type 7D enclosure approved for use in National Electric Code Class I, Group D, Div. I, atmosphere. Switch operable through shaft in matching cast metal cover. 20-ampere, 120/277-volt switch assemblies:

1. Crouse-Hinds Type EFS
2. Midland-Ross Type EFS
3. Appleton Electric Type EFS

## 2.05 FLUSH RECEPTACLES

A. Provide twenty-ampere, 125-volt flush receptacles constructed in flush device boxes, and of grounding type in composition case with insulated mounting yoke, side-wired, binding screw-type terminals.

B. Duplex receptacles:

1. Arrow-Hart Cat. No. 5739-S
2. Harvey Hubbell Cat. No. 5362
3. Bryant Electric Cat. No. 5362
4. Sierra Electric Cat. No. 14602

C. Single receptacles:

1. Arrow-Hart Cat. No. 5361
2. Harvey Hubbe 1 Cat. No. 5361
3. Bryant Electric Cat. No. 5361
4. Sierra Electric Cat. No. 12605

## 2.06 CLOCK RECEPTACLES

A. Provide 3-wire, 15-ampere, 125-volt hanger receptacle with flush stainless steel plate for each clock:

1. Arrow-Hart Cat. No. 5708
2. Harvey Hubbell Cat. No. 5235
3. Bryant Electric Cat. No. 2828GS
4. Sierra Electric Cat. No. 2123

## 2.07 SPECIAL RECEPTACLES

A. Provide weatherproof devices rated 20 ampere, 125-volt, consisting of single receptacles with spring-loaded, soft-gasketed hinged covers with stainless steel spring. Covers as follows:

1. Arrow-Hart Cat. No. 4500FS

2. Harvey Hubbell Cat. No. 5206

3. Bryant Electric Cat. No. 4510

B. Provide watertight, gasketed cast-metal enclosures with covers in areas subject to hose-down, meeting requirements, and either standard single or duplex type:
1. Appleton Electric Cat. No. AEE3382 and AEP3361, Style 2.

2. Crouse-Hinds Cat. No. ARRH3322 and APJ3385, Style 2.

3. Midland-Ross Cat. No. 3313 and 3317, Type SCA.

C. Provide receptacles with matching plug or cord cap designed to meet NEMA 4 requirements when plug, cord and receptacle are assembled.

D. Provide explosionproof 20-ampere receptacles, of the delayed action type, preventing contact from being broken until arc has been extinguished. Receptacles with angle covers and pring-closed flaps:

1. Crouse-Hinds Type CPS

2. Appleton Electric Type CPS

3. Midland-Ross Type EFS

E. Furnish one explosion proof plug for each three receptacles, with minimum of one, plugs to match receptacles and from same manufacturer:

F. Provide welding receptacles whereby plug ground contact makes contact with receptacle ground contact before current carrying contacts engage, and when withdrawing plug, ground contact remains engaged until after current carrying ground contacts disengage.

## 2.08 OUTLET BOXES AND ENCLOSURES

A. Provide outlet boxes and enclosures conforming to Section 16110, Electrical Raceway Systems unless otherwise indicated.

## 2.09 DEVICE PLATES

A. Provide device plates suitable for type of outlet boxes and enclosures used. Plates for flush-mounting by device manufacturer. Plates for surface-mounting boxes by either device manufacturer or box manufacturer.

B. Provide flush device plates of high corrosion resistant, Type 302 stainless steel. Provide plates of 93,000 series thickness, not less than 0.030 in.

C. Provide flush device plates with security (vandal proof) throughout.

D. Provide five (5) security screws screwdrivers at end of job to Owner.

## 2.10 NAMEPLATES

A. Provide nameplates or equivalent markings on switch enclosures to indicate ON and OFF positions of each switch. Do not use ON and OFF for 3-way or 4-way switches. Receptacles for special purpose shall hare nameplates indicating. their use, unless use is obvious. Nameplates shall otherwise conform to requirements specified under Section 16050.

# PART 3 EXECUTION

## 3.01 CONNECTION

A. Securely and rigidly attach wiring devices in accordance with regulating agency, and as indicated, avoiding interference with other equipment.

B. Securely fasten nameplates using screws, bolts, or rivets and centered under or on the device, unless otherwise indicated.

## 3.02 GROUNDING

A. Ground all devices.

B. Ground switches and their metal plates through switch mounting yoke, outlet box, and raceway system.

C. Ground flush receptacles and their metal plates through positive ground connection to outlet box and grounding system. Maintain ground to each receptacle by spring loaded grounding contact to mounting screw, or by grounding jumper, both making positive connection to outlet box and grounding system at all times.

D. Ground explosionproof receptacles and plugs by making contract between the metal shells, and also by using a grounding pin to make contact before power contacts are made.

**END OF SECTION 26 27 26**

**SECTION 26 51 00**

**LIGHTING**

## PART 1 GENERAL

### 1.01 DESCRIPTION

A. Furnish and install complete indoor lighting systems.

### 1.02 REFERENCE STANDARDS

A. Underwriters' Laboratories, Inc., 333 Pfingsten Road, Northbrook, IL.

B. National Fire Protection Association, Battery March Park, Quincy, MA, 02269 NFPA 70 1981, National Electrical Code.

C. Federal Specifications and Standards Superintendent of Documents U.S. Government Printing Office, Washington, D.C., 20402.

1. W-L-101(5) Lamp, Incandescent, (Electric, large, Tungsten Filament)

2. W-L-001166 Lamps, Fluorescent

3. W-L-142a Lampholder, adaptor, and shadeholder, medium screw-shell, 125, 250, and 600 volts.

D. American National Standards Institute:

1. Fluorescent Lamp Ballasts, ANSI C82, 1-1972 and Supplement C82.la.

2. High Intensity Discharge Lamp Reference Ballasts, ANSI C82.5-1975.

3. Mercury Lamp Ballasts, (Multiple Supply Type), ANSI C82.4-1974.

4. Electric Lamp Bases and Holders, Fluorescent Types, ANSI C81.20-1976.

5. Electric Lamp Bases and Holders, Screw-Shell Types, ANSI C81.10-1976.

### 1. 03 SUBMITTALS

A. Submit manufactures installation instructions in accordance with General Specifications.

B. Submit manufacturer's shop drawings including photometric data to show that fixtures proposed are of same type, construction and quality as those indicated. Lighting fixtures listed and labeled by Underwriters, Laboratories.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

A. Lighting equipment as indicated or specified.

### 2.02 LAMPS

A. Furnish lamps of types and wattages shown in fixture schedule.

B. Unless otherwise indicated, furnish fluorescent lamps suitable for 12-volt operation. Type: Rapid start, standard cool white, 48-in. long, 34 watt.

### 2.03 BALLASTS

A. Furnish high power factor type ballasts for fluorescent lamps. Ballasts are required to operate one, two, or four lamps as required by fixture schedule.

B. Ballast sound rating: "A"

C. Furnish ballasts class "p" type or equivalent protection, containing a nonrenewable, nonresetting thermal protector; designed for applicable indoor or outdoor use; conforming to UL standard 935.

D. Furnish ballasts with certified ballasts manufacturer (CBM) label.

E. Furnish ballasts with power factor not. less than 95 percent.

F. Furnish constant wattage (regulator) type ballasts for mercury vapor and metal halide lamps.

G. Ballasts: In non-air conditioned spaces, rate for operation in 40-deg. C temperature environment.

H. Furnish mercury vapor and other H.I.D. ballasts suitable for 120-volt, 277-volt or 480-volt operation as indicated.

### 2.04 FIXTURES

A. Furnish fixtures complete with lamps of wattage indicated.

B. Furnish each fluorescent fixture with ballasts of proper type and characteristics for lamps in fixture and with voltage rating as required by circuit in which fixture is connected.

**2.05 EMERGENCY LIGHTING AND EXIT LIGHTING FIXTURES**

Furnish types of fixtures shown in fixture schedule.

**PART 3 EXECUTION**

**3.01 LIGHTING FIXTURES AND LAMPS**

A. Install types and sizes indicated, complete. Deliver lamps of proper type, wattage and voltage rating to site and install in fixture prior to completion of project.

B. Install all fixtures to comply with applicable provisions of National Electrical Code. Suspend pendant fixtures by means of suitable. outlet box covertype aligners, each having flexible joint permitting unit to hang plumb. Install stems of 1/2-in. galvanized steel conduits, unless otherwise specified.

C. Use aligners of shock absorbing type, where, indicated.

D. Use vaportight aligners with vaportight fixtures.

E. Install each explosion-proof pendant fixture having stem longer than 12-in. (305 mm), with explosion-proof swivel or flexible fitting permitting fixture to hang plumb. Fixtures with stems shorter than 12-in. (305 mm) aligned by level outlet box mounting, explosion-proof swivels, or other-acceptable means:

F. Install recessed fluorescent fixtures in suspended ceiling openings in conformance with manufacturer's recommendations. Install fixtures with adjustable fittings to permit alignment with ceiling panels. install fixtures in fire-resistive type of suspended ceiling construction, equipped with fireproofing boxes constructed of materials of same fire rating as ceiling panels. Materials in conformance with UL approved building materials list.

G. Install accessories such as straps, mounting plates, nipples or brackets necessary for proper installation.

H. Connect emergency light fixtures to separate unswitched circuit in lighting panelboard in a lighting circuit breaker locked in closed position.

**END OF SECTION 26 51 00**