



**ISSUED FOR: Construction**

**PROJECT MANUAL**

For  
**HALCYON Building 1300**  
**CUMMING, GA**

**OWNER:**  
ROCAPOINT Partners  
3424 Peachtree Road, Suite 1140  
Atlanta, Georgia 30326

**ARCHITECT:**  
AKA Studio PC  
74 Woodstock Rd.  
Roswell, Georgia 30075  
Phone: 770-642-9030  
Fax: 770-209-7050

Project No. O-2002

Issue Date: 04.30.2020

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**DIVISION 32****Exterior Improvements**

Not Used

PEI - MEP - Proficient Engineering, Inc.  
 U&C - Structural - Uzon & Case.

HALCYON VILLAGE – Building #1300

AKA Studio, P.C. #O-2002

AKA - Architect - AKA Studio PC.

END OF DOCUMENT 00 01 10

DOCUMENT 003132 - GEOTECHNICAL DATA

1.1 GEOTECHNICAL DATA

- A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.
- B. A geotechnical investigation report for Project, prepared by Contour Engineering dated February 28, 2020 is available for viewing upon request to G.C. or Architect.

END OF DOCUMENT 003132

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## SECTION 006325 - SUBSTITUTION REQUEST FORM (DURING CONSTRUCTION)

NOTE: This form is for use by Prime Construction Contractor only. Submittals by others will be returned with no response.

PROJECT: \_\_\_\_\_

LOCATION: \_\_\_\_\_

OWNER: \_\_\_\_\_

DATE: \_\_\_\_\_

We hereby submit for your consideration the following substitution instead of the item specified or shown on the drawings:

Section:	Paragraph:	Specified Item:
_____	_____	_____

Proposed Substitution:

\_\_\_\_\_  
\_\_\_\_\_

Attach complete product data, drawings and descriptions of product, with fabrication and installation details. Provide laboratory tests if applicable.

Provide sample, if applicable. Indicate if sample will be provided under separate cover.

Include complete information on changes to drawings and/or specifications that proposed substitution will require for its proper installation.

Fill in blanks below: (Include attachments if space is insufficient. Failure to provide information will void submittal.)

A. LEED-related material and performance characteristics; list directly with specified item; include specified documentation:

Specified item:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Proposed substitution:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

## B. Reason(s) for proposed substitution: (check all that apply)

- ☐ 1. Request is equivalent to product/material/ assembly specified. (Note: Attach technical documentation.)
- ☐ 2. Specified product or method cannot be provided within the Contract Time. (Note: This request will not be considered if the product or method cannot be provided as a result of the Contractor's failure to pursue the work promptly, or to coordinate the various activities properly, or if the Contractor fails to place timely orders.)
- ☐ 3. Specified product or method cannot receive necessary approval by a governing authority, and the Contractor certifies that the requested substitution can be approved.
- ☐ 4. A substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting redesign and evaluation costs and the increased cost of other work by the Owner or separate contractors, and similar considerations.
- ☐ 5. Specified product or method cannot be provided in a manner which is compatible with other materials of the work, and the Contractor certifies that the substitution will overcome the incompatibility.
- ☐ 6. Specified product or method cannot be properly coordinated with other materials in the work, and the Contractor certifies that the proposed substitution can be properly coordinated.
- ☐ 7. Specified product or method cannot receive a warranty as required by the Contract Documents, and the Contractor certifies that the proposed substitution can receive the required warranty.

## C. Does the substitution affect dimensions or details shown on drawings:

☐ No☐ Yes. (Attach marked up prints of drawings showing changes required.)

## D. What effect does the substitution have on other trades?

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## E. Compare significant qualities of proposed substitution with those of work or product originally specified or shown on drawings. Include elements such as size, weight, durability, performance, visual effect

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## F. Coordination information. Include all changes required in other elements of the work in order to accommodate the substitution, including work performed by the Owner or separate contractors.

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- G. State effect the substitution will have on the work schedule in comparison to the schedule which would prevail without the proposed substitution. State the effect of the proposed substitution on the Contract Time.
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- H. Provide complete cost information, including a proposal of any net change in the Contract Amount.

- I. Manufacturer's warranties of the proposed and specified items are:

\_\_\_\_\_ Same \_\_\_\_\_ Different (explain on attachment)

The Undersigned Contractor certifies its opinion that, after thorough evaluation, the proposed substitution will result in work that in every significant respect will be equivalent to or superior to the work required by the original Contract Documents and that it will perform adequately in the application indicated. Rights to additional payment or time because of failure of the substitution to perform adequately are hereby waived.

The Undersigned hereby agrees to pay in full for any changes to design, including detailing and engineering costs caused by the requested substitution.

Submitted by: NOTE: Submittal void and will be discarded if unsigned or if signed by entity other than General Construction Contractor.

Signature: \_\_\_\_\_  
(Contractor's Authorized Representative)

\_\_\_\_\_  
(Title)

Contractor's Firm Name: \_\_\_\_\_

Date: \_\_\_\_\_

For use by Architect:

\_\_\_\_\_ Accepted \_\_\_\_\_ Accepted as Noted

\_\_\_\_\_ Not Accepted \_\_\_\_\_ Received Too Late

By: \_\_\_\_\_

Date: \_\_\_\_\_

Remarks: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

END OF FORM 006325

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DOCUMENT 007200 - GENERAL CONDITIONS

1.1 DOCUMENTS

- A. The “General Conditions of the Contract for Construction,” AIA Document, A201, 2007 Edition, hereby included by reference, shall govern the Work.

END OF DOCUMENT 007200

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## SECTION 011000 - SUMMARY

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Project information.
  - 2. Work covered by Contract Documents.
  - 3. Work under separate contracts.
  - 4. Purchase Contracts.
  - 5. Owner-furnished products.
  - 6. Access to site.
  - 7. Coordination with occupants.
  - 8. Work restrictions.
  - 9. Specification formats and conventions.

- B. Related Requirements:

- 1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

#### 1.3 PROJECT INFORMATION

- A. Project Identification: Halcyon Village Center

- 1. Project Location: Forsyth County, Georgia

- B. Owner: RocaPoint Partners  
390 East Paces Ferry Rd  
Suite 825  
Atlanta, Georgia 30305  
Tel: 404-424-9608

- C. Architect: AKA Studio, P.C.  
74 Woodstock Road, Roswell Georgia, 30075.  
Contact: Robert Zappulla  
Tel: 770-642-9030  
email: rzappulla@akastudiopc.com

- D. Architect's Consultants: The Architect has retained the following design professionals who have prepared other designated portions of the Contract Documents:
  - 1. MEP Engineer: Proficient Engineering, Inc.
  - 2. Structural Engineer: Uzun + Case, LLC
- E. Other Owner Consultants: The Owner has retained the following design professionals who have prepared other designated portions of the Contract Documents:
  - 1. Civil Engineer: Kimley-Horn and Associates, Inc.

#### 1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
  - 1. All structural components.
  - 2. All exterior finishes.
  - 3. All mechanical, electrical, and plumbing components.
  - 4. Provisions for utility connections.
  - 5. Vertical circulation components.
  - 6. Interior finishes as shown in Project Documents.
- B. Type of Contract:
  - 1. Project will be constructed under a single prime contract.

#### 1.5 PHASED CONSTRUCTION

- A. The Work shall be conducted in one phase. The project is expected to be substantially complete as indicated in Project Schedule.
- B. Before commencing Work of each phase, submit an updated copy of Contractor's construction schedule showing the sequence, commencement and completion dates for all phases of the Work.

#### 1.6 WORK BY OWNER

- A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.
- B. Preceding Work: Owner will perform the following construction operations at Project site. Those operations are scheduled to be substantially complete before work under this Contract begins.
  - 1. Provide building pads.
- C. Concurrent Work: Owner will perform the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.

1. First level tenant improvements.

D. Subsequent Work: Owner will perform the following additional work at site after Substantial Completion. Completion of that work will depend on successful completion of preparatory work under this Contract.

1. Plaza landscape, hardscape and finishes.

#### 1.7 WORK UNDER SEPARATE CONTRACTS

A. Interior build-out including interior partitions, all finishes, MEP systems, and other as determined by the Owner and/or Tenant. Interior build-out work by others shall also include design and permitting process.

B. Civil site work design, engineering, and construction.

C. Site improvements, landscape design, and construction.

#### 1.8 PURCHASE CONTRACTS

#### 1.9 OWNER-FURNISHED PRODUCTS

A. Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner-furnished products **and making building services connections**.

B. Owner-Furnished Products: to be determined.

#### 1.10 ACCESS TO SITE

A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

B. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

C. Use of Site: Unlimited use of Project site within the following prescribed notifications regarding the construction staging area and property limits indicated. Limit use of Project site to **areas within the Contract limits** indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Limits: Materials lay down area and storage and employee parking shall be mutually agreed upon by Owner and Contractor. The Contractor shall provide a site plan illustrating the use of the site. Confine construction operations to project site.

2. Limits: Limit site disturbance, including earthwork and clearing of vegetation, to 40 feet (12.2 m) beyond building perimeter; 10 feet (3 m) beyond surface walkways, patios, surface parking, and utilities less than 12 inches (300 mm) in diameter; 15 feet (4.5 m) beyond primary roadway curbs and main utility branch trenches; and 25 feet (7.6 m) beyond constructed areas with permeable surfaces (such as pervious paving areas, storm-water detention facilities, and playing fields) that require additional staging areas in order to limit compaction in the constructed area.
3. Driveways, Walkways and Entrances: Keep driveways, **parking garage, loading areas**, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
  - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
  - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- D. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

#### 1.11 COORDINATION WITH OCCUPANTS

- A. Owner Limited Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.
  1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Owner acceptance of the completed Work.
  2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Owner occupancy.
  3. Before limited Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed and Certificate of Occupancy issued. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of Work.
  4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of Work.

#### 1.12 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
  1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.



- B. On-Site Work Hours: No restrictions, other than local restrictions, coordinate with Owner.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
  - 1. Notify **Owner** not less than **two** days in advance of proposed utility interruptions.
  - 2. Obtain **Owner's** written permission before proceeding with utility interruptions.
- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
  - 1. Notify **Owner** not less than **two** days in advance of proposed disruptive operations.
  - 2. Obtain **Owner's** written permission before proceeding with disruptive operations.
- E. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet (8 m) of entrances, operable windows, or outdoor-air intakes.

#### 1.13 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using the 50-division format and CSI/CSC's "MasterFormat" numbering system.
  - 1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
  - 2. Division 01: Sections in Division 01 govern the execution of the Work of all Sections in the Specifications.
- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
  - 1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
  - 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. Occasionally, the indicative or subjective mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

- a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
  - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
  - 2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.
  - 3. Keynoting: Materials and products are identified by reference keynotes referencing scheduled on Drawings.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

## SECTION 012500 - SUBSTITUTION PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
  - 1. Section 012100 "Allowances" for products selected under an allowance.
  - 2. Section 012300 "Alternates" for products selected under an alternate.
  - 3. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

#### 1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
  - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
  - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

#### 1.4 ACTION SUBMITTALS

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Substitution Request Form: Use facsimile of form provided in Project Manual.
  - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Statement indicating why specified product or fabrication or installation cannot be provided.

- b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
  - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
  - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
  - e. Samples, where applicable or requested.
  - f. Certificates and qualification data, where applicable or requested.
  - g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
  - h. Research reports evidencing compliance with building code in effect for Project.
  - i. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
  - j. Complete cost data indicating material cost, installed cost, and savings, if any, resulting from proposed substitution.
  - k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
  - l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
  - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

## 1.5 QUALITY ASSURANCE

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

## 1.6 PROCEDURES

- A. Products are specified by reference standards, performance, manufacturer's name and model number or trade name.
  - 1. When specified only by reference standard or performance, Contractor may select any product meeting specified standards or performance requirements, by any manufacturer.
  - 2. When several products or manufacturers are specified as being acceptable, Contractor has the option of choosing among those named.
  - 3. When one product or manufacturer is specified or indicated as the "basis of design", "basis of selection", or "scheduled", Contractor shall bear costs associated with changes required for application or installation of other products or assemblies.
  - 4. When proprietary products are specified, substitutions will be allowed only by substitution provisions specified herein, unless it is specifically stated that no substitutions are allowed.
  - 5. Sustainable design substitutions:
    - a. Proposed substitutions shall:
      - 1) Meet aesthetic and programmatic intent of Construction Documents.
      - 2) Meet or exceed sustainable design requirements specified for this Project.
    - b. Proposed substitution requests shall include technical data, calculations, reports, and other supportive information to substantiate that the proposed substitutions meet or exceed the sustainable requirements specified for this Project.
    - c. Refer to Sustainable Design Requirements section and Sustainable Design Scorecard for particular requirements.
    - d. Refer to individual specification sections for specific material and performance requirements.
- B. Requests will be considered from Contractor only, following contract award.
- C. Contract sum shall be based only on products and systems specified in the Contract Documents.
- D. Substitution requests shall precede and shall not be made as part of shop drawings or product data submittals.
- E. Contractor shall coordinate installation of accepted substitutions with interfacing work, bearing re-design costs and marking approved changes in the Work to properly incorporate the substitutions, and shall waive all claims for additional costs related to use of acceptable substitutions which become apparent following acceptance.
- F. Contractor shall be responsible for payment of time for research, evaluation, selection, and re-design costs incurred by Architect and his consultants for substitutions.

## PART 2 - PRODUCTS

### 2.1 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 30 days prior to time required for preparation and review of related submittals.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
- a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
  - b. Requested substitution provides sustainable design characteristics that specified product provided for compliance with LEED requirements.
  - c. Substitution request is fully documented and properly submitted.
  - d. Requested substitution will not adversely affect Contractor's construction schedule.
  - e. Requested substitution has received necessary approvals of authorities having jurisdiction.
  - f. Requested substitution is compatible with other portions of the Work.
  - g. Requested substitution has been coordinated with other portions of the Work.
  - h. Requested substitution provides specified warranty.
  - i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Not allowed.

## PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

## SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Requirements:
  - 1. Section 012100 "Allowances" for procedural requirements for handling and processing allowances.
  - 2. Section 012300 "Unit Prices" for administrative requirements for using unit prices.
  - 3. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

## 1.3 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

## 1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
  - 1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
  - 2. Within 20 days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

- a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
  - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
  - c. Include costs of labor and supervision directly attributable to the change.
  - d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
  - e. Quotation Form: Use CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail."
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
  2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
  3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
  4. Include costs of labor and supervision directly attributable to the change.
  5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
  6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
  7. Quotation Form: Use CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail."

## 1.5 ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, base each Change Order proposal on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place. If applicable, include reasonable allowance for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
1. Include installation costs in purchase amount only where indicated as part of the allowance.
  2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
  3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.



4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the Purchase Order amount or Contractor's handling, labor, installation, overhead, and profit. Submit claims within 21 days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. Owner will reject claims submitted later than 21 days after such authorization.
  1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
  2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

#### 1.6 ADMINISTRATIVE CHANGE ORDERS

- A. Allowance Adjustment: See Section 012100 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.
- B. Unit-Price Adjustment: See Section 012200 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

#### 1.7 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Work Changes Proposal Request, Contractor will issue a Change Order for signatures of Owner and Architect on AIA Document G701.

#### 1.8 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
  1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
  1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

## SECTION 012900 - PAYMENT PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
  - 1. Section 012100 "Allowances" for procedural requirements governing the handling and processing of allowances.
  - 2. Section 012200 "Unit Prices" for administrative requirements governing the use of unit prices.
  - 3. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
  - 4. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

#### 1.3 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

#### 1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
  - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
    - a. Application for Payment forms with continuation sheets.
    - b. Submittal schedule.
    - c. Items required to be indicated as separate activities in Contractor's construction schedule.

2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
  3. Sub-schedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide sub-schedules showing values coordinated with each phase of payment.
  4. Sub-schedules for Separate Design Contracts: Where the Owner has retained design professionals under separate contracts who will each provide certification of payment requests, provide sub-schedules showing values coordinated with the scope of each design services contract as described in Section 011000 "Summary."
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
1. Identification: Include the following Project identification on the schedule of values:
    - a. Project name and location.
    - b. Name of Architect.
    - c. Architect's project number.
    - d. Contractor's name and address.
    - e. Date of submittal.
  2. Arrange schedule of values consistent with format of AIA Document G703.
  3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
  4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
  5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
    - a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.
  6. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
  7. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
  8. Purchase Contracts: Provide a separate line item in the schedule of values for each purchase contract. Show line-item value of purchase contract. Indicate owner payments or deposits, if any, and balance to be paid by Contractor.

9. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
  - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.
10. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

#### 1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
  1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment Application Times: Submit Application for Payment to Architect by the 25 of the month. The period covered by each Application for Payment is one month, ending on the last day of the month.
- D. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- E. Application for Payment Forms: Use forms provided by Owner for Applications for Payment. Sample copies are included in Project Manual.
- F. Application for Payment Forms: Use forms acceptable to Architect and Owner for Applications for Payment. Submit forms for approval with initial submittal of schedule of values.
- G. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
  1. Entries shall match data on the Schedule of Values and Contractor's construction schedule. Use updated schedules if revisions were made.
  2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.

3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
  4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
- H. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
  2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
  3. Provide summary documentation for stored materials indicating the following:
    - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- I. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. Include waivers of lien and similar attachments with each Application for Payment.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- J. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
  2. When an application shows completion of an item, submit conditional final or full waivers.
  3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
  4. Waiver Delays: Submit each Application for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
- K. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
  2. Schedule of values.
  3. Sustainable design submittal for project materials cost data.

4. Contractor's construction schedule (preliminary if not final).
  5. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
  6. Sustainable design action plans.
  7. Schedule of unit prices.
  8. Submittal schedule (preliminary if not final).
  9. List of Contractor's staff assignments.
  10. Copies of building permits.
  11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
  12. Certificates of insurance and insurance policies.
  13. Performance and payment bonds.
  14. Data needed to acquire Owner's insurance.
- L. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
  2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- M. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Completion of Project closeout requirements.
  2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
  3. Updated final statement, accounting for final changes to the Contract Sum.
  4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
  5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
  6. AIA Document G707, "Consent of Surety to Final Payment."
  7. Evidence that claims have been settled.
  8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
  9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

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## SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
  - 1. General coordination procedures.
  - 2. Coordination drawings.
  - 3. Requests for Information (RFIs).
  - 4. Project meetings.
- B. Related Requirements:
  - 1. Section 011200 "Multiple Contract Summary" for a description of the division of work among separate contracts and responsibility for coordination activities not in this Section.
  - 2. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
  - 3. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
  - 4. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.
  - 5. Section 019113 "General Commissioning Requirements" for coordinating the Work with Owner's Commissioning Authority.

## 1.3 DEFINITIONS

- A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

## 1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
  2. Number and title of related Specification Section(s) covered by subcontract.
  3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list telephone numbers including office and cellular telephone numbers and e-mail addresses. Provide names and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
1. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

## 1.5 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
  3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  2. Coordinate installation of different components with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
  3. Make adequate provisions to accommodate items scheduled for later installation.
- C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

- D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities [and activities of other contractors] to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's construction schedule.
  2. Preparation of the schedule of values.
  3. Installation and removal of temporary facilities and controls.
  4. Delivery and processing of submittals.
  5. Progress meetings.
  6. Preinstallation conferences.
  7. Project closeout activities.
  8. Startup and adjustment of systems.

## 1.6 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
    - a. Use applicable Contract Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
    - b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
    - c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
    - d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
    - e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
    - f. Indicate required installation sequences.
    - g. Indicate dimensions shown on the Contract Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical

- Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate sub-framing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
  3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
  4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
  5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
  6. Mechanical and Plumbing Work: Show the following:
    - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
    - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
    - c. Fire-rated enclosures around ductwork.
    - d. See Division 22 "Plumbing" and Division 23 "Heating, Ventilating, and Air-Conditioning (HVAC)" for any additional submittal requirements.
  7. Electrical Work: Show the following:
    - a. Runs of vertical and horizontal conduit 1-1/4 inches (32 mm) in diameter and larger.
    - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
    - c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
    - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
    - e. See Division 26 "Electrical" for any additional submittal requirements.
  8. Fire-Protection System: Show the following:
    - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
    - b. See Division 21 "Fire Suppression" for any additional submittal requirements.
  9. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.

10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 013300 "Submittal Procedures."

#### 1.7 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
  1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
  2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
  3. Include only one question per RFI unless multiple questions are specifically related to one material or system.
  4. RFI should request legitimate information or clarification that is not noted in Contract Documents.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
  1. Project name.
  2. Project number.
  3. Date.
  4. Name of Contractor.
  5. Name of Architect.
  6. RFI number, numbered sequentially.
  7. RFI subject.
  8. Specification Section number and title and related paragraphs, as appropriate.
  9. Drawing number and detail references, as appropriate.
  10. Field dimensions and conditions, as appropriate.
  11. Contractor's suggested resolution(s). If Contractor's suggested resolution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  12. Contractor's signature.
  13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- C. RFI Forms: AIA Document G716.
  1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:
    - a. Requests for approval of submittals.
    - b. Requests for approval of substitutions.
    - c. Requests for approval of Contractor's means and methods.
    - d. Requests for coordination information already indicated in the Contract Documents.
    - e. Requests for adjustments in the Contract Time or the Contract Sum.
    - f. Requests for interpretation of Architect's actions on submittals.
    - g. Incomplete RFIs or inaccurately prepared RFIs.
  2. Contractor shall anticipate questions and submit RFIs in a timely manner to provide for a reasonable response time for the Architect, so as not to delay the Work.
  3. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
  4. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
    - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log biweekly. Include the following:
1. Project name.
  2. Name and address of Contractor.
  3. Name and address of Architect.
  4. RFI number including RFIs that were returned without action or withdrawn.
  5. RFI description.
  6. Date the RFI was submitted.
  7. Date Architect's response was received.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.
1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
  2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.
- 1.8 PROJECT MEETINGS
- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
  2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
  3. Minutes: Contractor shall be responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
- B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
1. Conduct the conference to review responsibilities and personnel assignments.
  2. Attendees: Authorized representatives of Owner [, Owner's Commissioning Authority,] Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  3. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Tentative construction schedule.
    - b. Phasing.
    - c. Critical work sequencing and long-lead items.
    - d. Designation of key personnel and their duties.
    - e. Lines of communications.
    - f. Procedures for processing field decisions and Change Orders.
    - g. Procedures for RFIs.
    - h. Procedures for testing and inspecting.
    - i. Procedures for processing Applications for Payment.
    - j. Distribution of the Contract Documents.
    - k. Submittal procedures.
    - l. Sustainable design requirements. (Delete if separate sustainable design conference is required)
    - m. Preparation of record documents.
    - n. Use of the premises [and existing building].
    - o. Work restrictions.
    - p. Working hours.
    - q. Owner's occupancy requirements.
    - r. Responsibility for temporary facilities and controls.
    - s. Procedures for moisture and mold control.
    - t. Procedures for disruptions and shutdowns.
    - u. Construction waste management and recycling.
    - v. Parking availability.
    - w. Office, work, and storage areas.
    - x. Equipment deliveries and priorities.
    - y. First aid.
    - z. Security.
    - aa. Progress cleaning.

4. Minutes: Contractor shall be responsible for conducting meeting will record and distribute meeting minutes.
- C. Sustainable Design Coordination Conference: Owner will schedule and conduct a sustainable design coordination conference before starting construction, at a time convenient to Owner, Architect, and Contractor.
1. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Architect, and their consultants; Contractor and its superintendent and sustainable design coordinator; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Agenda: Discuss items of significance that could affect meeting sustainable design requirements, including the following:
    - a. Sustainable design Project checklist.
    - b. General requirements for sustainable design-related procurement and documentation.
    - c. Project closeout requirements and sustainable design certification procedures.
    - d. Role of sustainable design coordinator.
    - e. Construction waste management.
    - f. Construction operations and sustainable design requirements and restrictions.
  3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- D. Pre-installation Conferences: Conduct a pre-installation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect, and Owner's representative of scheduled meeting dates.
  2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
    - a. Contract Documents.
    - b. Options.
    - c. Related RFIs.
    - d. Related Change Orders.
    - e. Purchases.
    - f. Deliveries.
    - g. Submittals.
    - h. Sustainable design requirements.
    - i. Review of mockups.
    - j. Possible conflicts.
    - k. Compatibility requirements.



- l. Time schedules.
    - m. Weather limitations.
    - n. Manufacturer's written instructions.
    - o. Warranty requirements.
    - p. Compatibility of materials.
    - q. Acceptability of substrates.
    - r. Temporary facilities and controls.
    - s. Space and access limitations.
    - t. Regulations of authorities having jurisdiction.
    - u. Testing and inspecting requirements.
    - v. Installation procedures.
    - w. Coordination with other work.
    - x. Required performance results.
    - y. Protection of adjacent work.
    - z. Protection of construction and personnel.
  - 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
  - 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
  - 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- E. Progress Meetings: Conduct progress meetings at monthly intervals.
- 1. Coordinate dates of meetings with preparation of payment requests.
  - 2. Attendees: In addition to representatives of Owner [, Owner's Commissioning Authority] and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
  - 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      - 1) Review schedule for next period.
    - b. Review present and future needs of each entity present, including the following:
      - 1) Interface requirements.

- 2) Sequence of operations.
  - 3) Status of submittals.
  - 4) Status of sustainable design documentation.
  - 5) Deliveries.
  - 6) Off-site fabrication.
  - 7) Access.
  - 8) Site utilization.
  - 9) Temporary facilities and controls.
  - 10) Hazards and risks.
  - 11) Progress cleaning.
  - 12) Quality and work standards.
  - 13) Status of correction of deficient items.
  - 14) Field observations.
  - 15) Status of RFIs.
  - 16) Status of proposal requests.
  - 17) Pending changes.
  - 18) Status of Change Orders.
  - 19) Pending claims and disputes.
  - 20) Documentation of information for payment requests.
4. Minutes: Contractor shall be responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
    - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- F. Coordination Meetings: Conduct Project coordination meetings at **regular** intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and pre-installation conferences.
1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

- b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
  - c. Review present and future needs of each contractor present, including the following:
    - 1) Interface requirements.
    - 2) Sequence of operations.
    - 3) Status of submittals.
    - 4) Deliveries.
    - 5) Off-site fabrication.
    - 6) Access.
    - 7) Site utilization.
    - 8) Temporary facilities and controls.
    - 9) Work hours.
    - 10) Hazards and risks.
    - 11) Progress cleaning.
    - 12) Quality and work standards.
    - 13) Change Orders.
3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

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## SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
  - 1. Preconstruction photographs.
  - 2. Periodic construction photographs.
  - 3. Final completion construction photographs.
- B. Related Requirements:
  - 1. Section 013300 "Submittal Procedures" for submitting photographic documentation.
  - 2. Section 017700 "Closeout Procedures" for submitting photographic documentation as project record documents at Project closeout.

## 1.3 ALLOWANCES

- A. Costs: Photographic documentation services are included under the cash allowance for construction photographic services established in Section 012100 "Allowances."

## 1.4 UNIT PRICES

- A. Basis for Bids: Base number of construction photographs on average of **20** photographs per **week** over the duration of Project.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Digital Photographs: Submit image files within three days of taking photographs.
  - 1. Digital Camera: Minimum sensor resolution of 8 megapixels.
  - 2. Format: Minimum 3600 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph.
  - 3. Identification: Provide the following information with each image description in file metadata tag:

- a. Name of Project.
  - b. Name and contact information for photographer.
  - c. Name of Architect.
  - d. Name of Contractor.
  - e. Date photograph was taken.
  - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
- B. Construction Photographs: Submit four prints of each photographic view within seven days of taking photographs.
  1. Format: 8-by-10-inch (203-by-254-mm) smooth-surface matte prints on single-weight, commercial-grade photographic paper; enclosed back to back in clear plastic sleeves that are punched for standard three-ring binder.
  2. Identification: On back of each print, provide an applied label or rubber-stamped impression with the following information:
    - a. Name of Project.
    - b. Name and contact information for photographer.
    - c. Name of Architect.
    - d. Name of Contractor.
    - e. Date photograph was taken if not date stamped by camera.
    - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.

## 1.6 QUALITY ASSURANCE

- A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.

## 1.7 USAGE RIGHTS

- A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

## PART 2 - PRODUCTS

### 2.1 PHOTOGRAPHIC MEDIA

- A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3600 by 2400 pixels.

## PART 3 - EXECUTION

## 3.1 CONSTRUCTION PHOTOGRAPHS

- A. Photographer: Engage a qualified photographer to take construction photographs.
- B. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
- C. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
  - 1. Date and Time: Include date and time in file name for each image.
  - 2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect.
- D. Preconstruction Photographs: Before **starting construction**, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by **Architect or Construction Manager**.
  - 1. Flag **construction limits** before taking construction photographs.
  - 2. Take **20** photographs to show existing conditions adjacent to property before starting the Work.
  - 3. Take **20** photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
  - 4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- E. Periodic Construction Photographs: Provide one aerial and 20 photographs monthly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.
- F. Progress Construction Photographs: Provide a minimum of 10 digital images each week of site and construction throughout progress of Work as part of the Daily Construction Report.
- G. Additional Photographs: In addition to periodic, reoccurring views, provide a minimum of 10 digital images of each of the following events:
  - 1. Completion of site clearing.
  - 2. Excavations in progress.
  - 3. Foundations in progress and upon completion.
  - 4. Structural framing in progress and upon completion.
  - 5. Enclosure of building and upon completion.

- H. Architect-Directed Construction Photographs: From time to time, Architect will instruct photographer about number and frequency of photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.
- I. Time-Lapse Sequence Construction Photographs: Take 20 photographs as indicated, to show status of construction and progress since last photographs were taken.
  - 1. Frequency: Take photographs **weekly, with timing each month adjusted to coincide** with the cutoff date associated with each Application for Payment.
  - 2. Vantage Points: Following suggestions by Architect and Contractor, photographer to select vantage points. During each of the following construction phases, take not less than two of the required shots from same vantage point each time to create a time-lapse sequence as follows:
    - a. Commencement of the Work, through completion of subgrade construction.
    - b. Above-grade structural framing.
    - c. Exterior building enclosure.
    - d. Interior Work, through date of Substantial Completion.
- J. Final Completion Construction Photographs: Provide 20 digital images after date of Substantial Completion for submission as project record documents.
  - 1. Do not include date stamp.
- K. Special Request Photographs: Architect may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.
  - 1. Three days' notice will be given, where feasible.
  - 2. In emergency situations, take additional photographs within 24 hours of request.
  - 3. Circumstances that could require additional photographs include, but are not limited to, the following:
    - a. Special events planned at Project site.
    - b. Immediate follow-up when on-site events result in construction damage or losses.
    - c. Photographs to be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
    - d. Substantial Completion of a major phase or component of the Work.
    - e. Extra record photographs at time of final acceptance.
    - f. Owner's request for special publicity photographs.

END OF SECTION 013233



## SECTION 013300 - SUBMITTAL PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
  - 1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the Schedule of Values.
  - 2. Section 013100 "Project Management and Coordination" for submitting coordination drawings.
  - 3. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
  - 4. Section 014000 "Quality Requirements" for submitting test and inspection reports and for mockup requirements.
  - 5. Section 017700 "Closeout Procedures" for submitting warranties.
  - 6. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
  - 7. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
  - 8. Divisions 02 through 49 Sections for specific requirements for submittals in those Sections.

#### 1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

- C. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

#### 1.4 ACTION SUBMITTALS

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
  - 1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
  - 2. Initial Submittal: Provide within 14 days of date established for commencement of the Work. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
  - 3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
  - 4. Format: Arrange the following information in a tabular format:
    - a. Scheduled date for first submittal.
    - b. Specification Section number and title.
    - c. Submittal category: Action; informational.
    - d. Name of subcontractor.
    - e. Description of the Work covered.
    - f. Scheduled date for Architect's final release or approval.
    - g. Scheduled date of fabrication.
    - h. Scheduled dates for purchasing.
    - i. Scheduled dates for installation.
    - j. Activity or event number.

#### 1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
  - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  - 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
  - 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.

4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
  - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
  1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
  2. Resubmittal Review: Allow 15 days for review of each resubmittal.
  3. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
    - a. Division 05 "Metals".
    - b. Division 14 "Conveying Equipment".
    - c. Division 21 "Fire Suppression".
    - d. Division 22 "Plumbing".
    - e. Division 23 "Heating, Ventilating, and Air-Conditioning (HVAC)".
    - f. Division 26 "Electrical".
    - g. Division 28 "Electronic Safety and Security".
- D. Paper Submittals: Identify and incorporate information in each paper submittal as follows:
  1. Indicate name of firm or entity that prepared each submittal on cover sheet.
  2. Provide a space approximately 6 by 8 inches (150 by 200 mm) on cover sheet to record Contractor's review and approval markings and action taken by Architect.
  3. Include the following information for processing and recording action taken:
    - a. Project name.
    - b. Date.
    - c. Name of Architect.
    - d. Name of Contractor.
    - e. Name of subcontractor.
    - f. Name of manufacturer.
    - g. Submittal number or other unique identifier, including revision identifier.
      - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
    - h. Number and title of appropriate Specification Section.
    - i. Drawing number and detail references, as appropriate.

4. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will discard submittals received from sources other than Contractor.
  - a. Transmittal Form for Paper Submittals: Provide locations on form for the following information:
    - 1) Project name.
    - 2) Date.
    - 3) Destination (To:).
    - 4) Source (From:).
    - 5) Name and address of Architect.
    - 6) Name of Contractor.
    - 7) Name of subcontractor.
    - 8) Category and type of submittal.
    - 9) Number of enclosed copies.
    - 10) Submittal purpose and description.
    - 11) Transmittal number.
    - 12) Submittal and transmittal distribution record.
    - 13) Remarks.
    - 14) Signature of transmitter.
- E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
  1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section.
  2. Indicate name of firm or entity that prepared each submittal on cover sheet.
  3. Provide a space approximately 6 by 8 inches (150 by 200 mm) on cover sheet to record Contractor's review and approval markings and action taken by Architect.
  4. Include the following information for processing and recording action taken:
    - a. Comply with requirements under Paper Submittals.
  5. Transmittal Form for Electronic Submittals: Provide locations on form for the following information:
    - a. Comply with requirements under Paper Submittals.
- F. Sample Submittals: Identify and incorporate information in each sample submittal as follows:
  1. Indicate name of firm or entity that prepared each submittal on a label.
  2. Provide a space approximately 6 by 8 inches (150 by 200 mm) on label to record Contractor's review and approval markings and action taken by Architect.
  3. Include the following information for processing and recording action taken:

- a. Comply with requirements under Paper Submittals.
- 4. Transmittal Form for Electronic Submittals: Provide locations on form for the following information:
  - a. Comply with requirements under Paper Submittals.
- G. Resubmittals: Make resubmittals in same form as initial submittal.
  - 1. Note date and content of revision in label or title block and clearly indicate extent of revision for shop drawing submittals.
  - 2. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- I. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

## PART 2 - PRODUCTS

### 2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
  - 1. Submit electronic submittals via email as PDF electronic files.
    - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
  - 2. Action Submittals: Submit three paper copies of each submittal unless otherwise indicated. Architect will return two copies.
  - 3. Informational Submittals: Submit two paper copies of each submittal unless otherwise indicated. Architect will not return copies.
  - 4. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
  - 1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.

2. Mark each copy of each submittal to show which products and options are applicable.
  3. Include the following information, as applicable:
    - a. Manufacturer's catalog cuts.
    - b. Manufacturer's product specifications.
    - c. Manufacturer's written recommendations.
    - d. Manufacturer's installation instructions.
    - e. Standard color charts.
    - f. Compliance with recognized trade association standards.
    - g. Compliance with recognized testing agency standards.
    - h. Location(s) where product is to be installed, as appropriate.
    - i. Provide unique identifier coordinated with Contract Documents on each submitted item to indicate use of product, as appropriate.
  4. For equipment, include the following in addition to the above, as applicable:
    - a. Wiring diagrams showing factory-installed wiring.
    - b. Printed performance curves.
    - c. Operational range diagrams.
    - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
  5. Submit Product Data before or concurrent with Samples.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    - a. Dimensions.
    - b. Identification of products.
    - c. Fabrication and installation drawings.
    - d. Roughing-in and setting diagrams.
    - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
    - f. Shopwork manufacturing instructions.
    - g. Templates and patterns.
    - h. Schedules.
    - i. Design calculations, if specified.
    - j. Compliance with specified standards.
    - k. Notation of coordination requirements.
    - l. Notation of dimensions established by field measurement.
    - m. Relationship and attachment to adjoining construction clearly indicated.
    - n. Seal and signature of professional engineer if specified.
    - o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm), but no larger than 30 by 42 inches (750 by 1067 mm).
  3. Submit Shop Drawings in the following format:
    - a. Paper or electronic copy.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
  2. Identification: Attach label on unexposed side of Samples that includes the following:
    - a. Generic description of Sample.
    - b. Product name and name of manufacturer.
    - c. Sample source.
    - d. Number and title of applicable Specification Section.
    - e. Specification paragraph number and generic name of each item.
  3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
  4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
  5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
    - a. Number of Samples: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
  6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
    - a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned.

- E. Product Schedule: Prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
  - 1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
  - 2. Manufacturer and product name, and model number if applicable.
  - 3. Submit product schedule in the following format:
    - a. Paper or electronic copy.
- F. Coordination Drawing Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."
- G. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."
- H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."
- I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."
- J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."
- K. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."
- L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized by manufacturer for this specific Project.
- O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.
- P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements.
- Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements.



- R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.
- S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
  - 1. Name of evaluation organization.
  - 2. Date of evaluation.
  - 3. Time period when report is in effect.
  - 4. Product and manufacturers' names.
  - 5. Description of product.
  - 6. Test procedures and results.
  - 7. Limitations of use.
- U. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- V. Field Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements.
- W. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- X. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer.
- Y. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections.
- Z. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

## 2.2 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
  - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file or three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
  - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

## PART 3 - EXECUTION

### 3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

### 3.2 ARCHITECT'S ACTION

- A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:
  - 1. No Exception Taken – Make Corrections Noted – Rejected – Revise and Resubmit – Submit Specified Item – Submittal Receipt Acknowledged.
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

- C. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- D. Incomplete or resubmitted submittals requiring more than two reviews will be considered nonresponsive and shall be subjected to a surcharge at the Architect's hourly rate; two hour minimum, to the Contractor.
- E. Submittals not required by the Contract Documents will not be reviewed and may be discarded by Architect without action.

END OF SECTION 013300

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## SECTION 013330 - STRUCTURAL SUBMITTALS

## PART 1 - GENERAL

## 1.1 SECTION INCLUDES

- A. Structural submittals include shop drawings, design calculations, diagrams, illustrations, schedules, performance charts, nomenclature charts, samples, brochures and other data prepared by the Contractor or any subcontractor, manufacturer, supplier, fabricator, or distributor and which illustrate some portion of the Project.
- B. Submittals by the Contractor are not a part of the Contract Documents.

## 1.2 RELATED SECTIONS

- A. Section 01 33 00 - Submittals

## 1.3 SUBMITTAL PROCEDURES

- A. Prior to the initial submittal, Contractor shall submit to the Design Professional a completed *Submittal Information and Schedules* form given in Appendix I.
- B. Submittals shall be accompanied by a transmittal letter with the following information:
  - 1. Project name.
  - 2. Contractor's name.
  - 3. Date submitted.
  - 4. Description of items submitted; identify work and product by Specification Section.
  - 5. Number of drawings and other pertinent data.
- C. Provide blank space on each submittal for the Design Professional's review stamp.
- D. The type and number of submittals for each item shall be in accordance with Section 013000.
- E. Contractor shall direct specific attention on the submittal to any deviation from the Contract Documents.

## 1.4 CONTRACTOR RESPONSIBILITY

- A. Contractor shall make all submittals in advance of installation or construction to allow the Design Professional sufficient time for review.
- B. Contractor shall stamp and sign each sheet of shop drawings and product data, and sign or initial each sample to certify compliance with requirements of Contract Documents.

SUBMITTALS RECEIVED WITHOUT THE CONTRACTOR'S STAMP OF REVIEW WILL BE RETURNED TO THE CONTRACTOR FOR REVIEW AND RESUBMITTAL.

- C. Contractor shall understand that the submittal of the required documents does not constitute compliance with the requirements of the Contract Documents; only submittals reviewed by the Design Professional constitute compliance.
- D. It is the Contractor's responsibility to furnish equipment, materials, and labor for the Project which meets the requirements of the codes and authorities quoted as well as the Contract Documents. Proprietary items specified herein only establish a minimum functional and aesthetic standard and it is incumbent upon the Contractor to ascertain conformance of these proprietary items or any proposed substitution with the codes and authorities.
- E. By reviewing, approving and submitting shop drawings, product data, or samples, Contractor thereby represents that he has determined and verified all field measurements, field construction criteria, materials, member sizes catalog numbers, and similar data and that he has checked and coordinated shop drawings with the requirements of the Project and of the Contract Documents.
- F. Work requiring shop drawings, whether called for by the Contract Documents or requested by the Contractor, shall not commence until the submission has been reviewed by the Design Professional. Work may commence if the Contractor verifies the accuracy of the Design Professional's corrections and notations and complies with them without exception and without requesting change in Contract Sum or Contract Time.

#### 1.5 DESIGN PROFESSIONAL REVIEW

- A. Design Professional will review submittals with reasonable promptness.
- B. Design Professional's review or corrections refer only to the general arrangement and conformance of the subject of the submittals with the design concept of the project and with the information given in the Contract Documents. Under no conditions should the Contractor consider the review to include the dimensions, quantities, and details of the items nor the approval of an assembly in which the item functions.
- C. Design Professional's review shall not relieve the Contractor from responsibility for errors or omissions in the submittals.
- D. Design Professional's review of submittals shall not relieve the Contractor of responsibility for any deviation from the requirements of the Contract Documents unless the Contractor has directed specific attention to the deviation at the time of submission and the Design Professional has given written approval to the specific deviation.
- E. Design Professional's review of submittals shall not be construed as authorizing any change in the Contract Sum or Contract Time.

## 1.6 SHOP DRAWINGS

- A. Present in a clear and thorough manner. Title each drawing with Project name and number; identify each element of drawings by reference to sheet number and detail of Contract Documents Sustainable Design Submittals:
- B. Reproduction of Structural Drawings for shop drawings is not permitted. Electronic drawing files will not be provided to the Contractor.
- C. Identify field dimensions; show relationship to adjacent or critical features of Work or products.
- D. A copy of the marked structural shop drawings with the Design Professional's review stamp is to be maintained at the job site.

## 1.7 PRODUCT DATA

- A. Submit only pages which are pertinent; mark each copy of standard printed data to identify pertinent products, referenced to Specification Section and Article number. Show reference standards, performance characteristics, and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions; and required clearances.
- B. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information which is not applicable.
- C. Provide manufacturer's preparation, assembly, and installation instructions.

## 1.8 SAMPLES

- A. Submit full range of manufacturer's standard finishes except where more restrictive requirements are specified, indicating colors, textures, and patterns.
- B. Submit samples to illustrate functional characteristics of products, including parts and attachments as required by Design Professional.
- C. Approved samples which are of proper size may be incorporated in Work.
- D. Label each sample with identification.
- E. Field Finishes: Provide full samples at Project, at location acceptable to Design Professional, as required by individual Specification Section. Install each sample complete and finished. Acceptable finishes in place may be retained in completed work.

## 1.9 RESUBMITTALS

- A. When submittals are returned to the Contractor with the Design Professional's corrections the Contractor shall make the required corrections. Upon request, resubmit one corrected set.

- B. Contractor shall direct specific attention on the resubmittal to all revisions including those requested by the Design Professional on previous submission.

1.10 DISTRIBUTION

- A. Distribute reproductions of shop drawings, copies of product data, and samples which bear the Design Professional's review stamp to job site file, Record Documents file, subcontractors, suppliers, other affected contractors, and other entities requiring information.
- B. Work shall be in accordance with and performed from the reviewed drawings.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

END OF SECTION 013330



APPENDIX I  
SUBMITTAL INFORMATION AND SCHEDULES

PROJECT \_\_\_\_\_

CONTRACTOR \_\_\_\_\_

CONTRACTOR'S ADDRESS \_\_\_\_\_

PROJ. MANAGER \_\_\_\_\_ PHONE (\_\_\_\_) \_\_\_\_\_ FAX (\_\_\_\_) \_\_\_\_\_

SUPERINTENDENT \_\_\_\_\_ PHONE (\_\_\_\_) \_\_\_\_\_ FAX (\_\_\_\_) \_\_\_\_\_

MOBILIZATION DATE \_\_\_\_\_

PROJECTED SUBMITTAL DATES

FOUNDATION, CONCRETE & REINFORCING		STRUCTURAL STEEL		MASONRY	
SUBMITTAL	DATE	SUBMITTAL	DATE	SUBMITTAL	DATE
Site Preparation & Equipment Information		Fabricator / Erec- tor Qualifications		Grout & Mortar Mix	
Concrete Mix Design		Anchor Bolt & Embedded Items		Block Prism & Comp. Strength	
Foundation Reinforcing		Erection & Detail Drawings		Reinforcing	
				Written Procedures	
		Joists			
		Deck			

Remarks:

COMPLETED BY \_\_\_\_\_ DATE \_\_\_\_\_

END OF APPENDIX

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## SECTION 014000 - QUALITY REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
  - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
  - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
  - 3. Requirements for Contractor to provide quality-assurance and control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
  - 4. Specific test and inspection requirements are not specified in this Section.
- C. Related Requirements:
  - 1. Section 013200 "Construction Progress Documentation" for developing a schedule of required tests and inspections.
  - 2. Section 014523 "Testing and Inspection Services" for Owner paid testing and inspections services.
  - 3. Division 02 through 49 Sections for specific test and inspection requirements.

#### 1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the

Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

- C. Mockups: Full-size, physical example assemblies that are constructed to illustrate finishes and materials. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
  - 1. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
  - 2. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.
- D. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- E. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- F. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- G. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
  - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- H. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

#### 1.4 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply

exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Retain "Contractor's Statement of Responsibility" Paragraph below when local code requirements stipulate submittal to authorities having jurisdiction of Contractor's statement of responsibility for seismic- or wind-force-resisting system construction and if an informational submittal is required. See requirements in the 2006 IBC, Sections 1705 and 1706.
- B. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
  - 1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
  - 2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.
- C. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- D. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of Codes, loads, and other factors used in performing these services.

## 1.6 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
  - 1. Date of issue.
  - 2. Project title and number.
  - 3. Name, address, and telephone number of testing agency.
  - 4. Dates and locations of samples and tests or inspections.
  - 5. Names of individuals making tests and inspections.
  - 6. Description of the Work and test and inspection method.
  - 7. Identification of product and Specification Section.
  - 8. Complete test or inspection data.
  - 9. Test and inspection results and an interpretation of test results.

10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
  11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
  12. Name and signature of laboratory inspector.
  13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of technical representative making report.
  2. Statement on condition of substrates and their acceptability for installation of product.
  3. Statement that products at Project site comply with requirements.
  4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
  5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  6. Statement whether conditions, products, and installation will affect warranty.
  7. Other required items indicated in individual Specification Sections.
- C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

## 1.7 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those

performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
  - 1. Requirements of authorities having jurisdiction shall supersede building codes and similar regulations governing the Work, nor interfere with local trade-union jurisdictional settlements and similar conventions.
- G. Testing Agency Qualifications: An independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
  - 1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
  - 2. Notify Architect not less than seven days in advance of dates and times when mockups will be constructed.
  - 3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
  - 4. Demonstrate the proposed range of aesthetic effects and workmanship.
  - 5. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
  - 6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  - 7. Demolish and remove mockups when directed unless otherwise indicated.
- K. Integrated Exterior Mockups: Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.
- L. Room Mockups: Construct room mockups incorporating required materials and assemblies, finished according to requirements. Provide required lighting and

additional lighting where required to enable Architect to evaluate quality of the Work. Provide room mockups of the following rooms:

1. Restroom
2. Locker Room
3. Entrance Lobby

## 1.8 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
  2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction.
  2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
    - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
  3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
  4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
  5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."
- D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences,



examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

- E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the requirements established by the Contract Documents.
- F. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
  - 1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  - 2. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
  - 3. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
  - 4. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
  - 5. Do not perform any duties of Contractor.
- G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
  - 1. Access to the Work.
  - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
  - 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
  - 4. Facilities for storage and field curing of test samples.
  - 5. Delivery of samples to testing agencies.
  - 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  - 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
  - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

## 3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
  - 1. Date test or inspection was conducted.
  - 2. Description of the Work tested or inspected.
  - 3. Date test or inspection results were transmitted to Architect.
  - 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's [, **Commissioning Authority's,**] reference during normal working hours.

## 3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
  - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017329 "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

## SECTION 014200 - REFERENCES

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

## 1.2 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.
- C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.
- J. "Installer/Applicator/Erector": Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- K. “Experienced”: When used with an entity, “experienced” means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

### 1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Conflicting Requirements: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.
  1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.
- D. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
  1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

### 1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
  1. AABC - Associated Air Balance Council; [www.aabc.com](http://www.aabc.com).
  2. AAMA - American Architectural Manufacturers Association; [www.aamanet.org](http://www.aamanet.org).

3. AAPFCO - Association of American Plant Food Control Officials; [www.aapfco.org](http://www.aapfco.org).
4. AASHTO - American Association of State Highway and Transportation Officials; [www.transportation.org](http://www.transportation.org).
5. AATCC - American Association of Textile Chemists and Colorists; [www.aatcc.org](http://www.aatcc.org).
6. ABMA - American Bearing Manufacturers Association; [www.americanbearings.org](http://www.americanbearings.org).
7. ABMA - American Boiler Manufacturers Association; [www.abma.com](http://www.abma.com).
8. ACI - American Concrete Institute; (Formerly: ACI International); [www.abma.com](http://www.abma.com).
9. ACPA - American Concrete Pipe Association; [www.concrete-pipe.org](http://www.concrete-pipe.org).
10. AEIC - Association of Edison Illuminating Companies, Inc. (The); [www.aeic.org](http://www.aeic.org).
11. AF&PA - American Forest & Paper Association; [www.afandpa.org](http://www.afandpa.org).
12. AGA - American Gas Association; [www.aga.org](http://www.aga.org).
13. AHAM - Association of Home Appliance Manufacturers; [www.aham.org](http://www.aham.org).
14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); [www.ahrinet.org](http://www.ahrinet.org).
15. AI - Asphalt Institute; [www.asphaltinstitute.org](http://www.asphaltinstitute.org).
16. AIA - American Institute of Architects (The); [www.aia.org](http://www.aia.org).
17. AISC - American Institute of Steel Construction; [www.aisc.org](http://www.aisc.org).
18. AISI - American Iron and Steel Institute; [www.steel.org](http://www.steel.org).
19. AITC - American Institute of Timber Construction; [www.aitc-glulam.org](http://www.aitc-glulam.org).
20. AMCA - Air Movement and Control Association International, Inc.; [www.amca.org](http://www.amca.org).
21. ANSI - American National Standards Institute; [www.ansi.org](http://www.ansi.org).
22. AOSA - Association of Official Seed Analysts, Inc.; [www.aosaseed.com](http://www.aosaseed.com).
23. APA - APA - The Engineered Wood Association; [www.apawood.org](http://www.apawood.org).
24. APA - Architectural Precast Association; [www.archprecast.org](http://www.archprecast.org).
25. API - American Petroleum Institute; [www.api.org](http://www.api.org).
26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
27. ARI - American Refrigeration Institute; (See AHRI).
28. ARMA - Asphalt Roofing Manufacturers Association; [www.asphaltroofing.org](http://www.asphaltroofing.org).
29. ASCE - American Society of Civil Engineers; [www.asce.org](http://www.asce.org).
30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; [www.ashrae.org](http://www.ashrae.org).
32. ASME - ASME International; (American Society of Mechanical Engineers); [www.asme.org](http://www.asme.org).
33. ASSE - American Society of Safety Engineers (The); [www.asse.org](http://www.asse.org).
34. ASSE - American Society of Sanitary Engineering; [www.asse-plumbing.org](http://www.asse-plumbing.org).
35. ASTM - ASTM International; [www.astm.org](http://www.astm.org).
36. ATIS - Alliance for Telecommunications Industry Solutions; [www.atis.org](http://www.atis.org).
37. AWEA - American Wind Energy Association; [www.awea.org](http://www.awea.org).
38. AWI - Architectural Woodwork Institute; [www.awinet.org](http://www.awinet.org).
39. AWMAC - Architectural Woodwork Manufacturers Association of Canada; [www.awmac.com](http://www.awmac.com).
40. AWWPA - American Wood Protection Association; [www.awpa.com](http://www.awpa.com).
41. AWS - American Welding Society; [www.aws.org](http://www.aws.org).
42. AWWA - American Water Works Association; [www.awwa.org](http://www.awwa.org).

43. BHMA - Builders Hardware Manufacturers Association; [www.buildershardware.com](http://www.buildershardware.com).
44. BIA - Brick Industry Association (The); [www.gobrick.com](http://www.gobrick.com).
45. BICSI - BICSI, Inc.; [www.bicsi.org](http://www.bicsi.org).
46. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); [www.bifma.org](http://www.bifma.org).
47. BISSC - Baking Industry Sanitation Standards Committee; [www.bissc.org](http://www.bissc.org).
48. BWF - Badminton World Federation; (Formerly: International Badminton Federation); [www.bissc.org](http://www.bissc.org).
49. CDA - Copper Development Association; [www.copper.org](http://www.copper.org).
50. CEA - Canadian Electricity Association; [www.electricity.ca](http://www.electricity.ca).
51. CEA - Consumer Electronics Association; [www.ce.org](http://www.ce.org).
52. CFFA - Chemical Fabrics and Film Association, Inc.; [www.chemicalfabricsandfilm.com](http://www.chemicalfabricsandfilm.com).
53. CFSEI - Cold-Formed Steel Engineers Institute; [www.cfsei.org](http://www.cfsei.org).
54. CGA - Compressed Gas Association; [www.cganet.com](http://www.cganet.com).
55. CIMA - Cellulose Insulation Manufacturers Association; [www.cellulose.org](http://www.cellulose.org).
56. CISCA - Ceilings & Interior Systems Construction Association; [www.cisca.org](http://www.cisca.org).
57. CISPI - Cast Iron Soil Pipe Institute; [www.cispi.org](http://www.cispi.org).
58. CLFMI - Chain Link Fence Manufacturers Institute; [www.chainlinkinfo.org](http://www.chainlinkinfo.org).
59. CPA - Composite Panel Association; [www.pbmdf.com](http://www.pbmdf.com).
60. CRD - Handbook for Concrete and Cement.
61. CRI - Carpet and Rug Institute (The); [www.carpet-rug.org](http://www.carpet-rug.org).
62. CRRC - Cool Roof Rating Council; [www.coolroofs.org](http://www.coolroofs.org).
63. CRSI - Concrete Reinforcing Steel Institute; [www.crsi.org](http://www.crsi.org).
64. CSA - Canadian Standards Association; [www.csa.ca](http://www.csa.ca).
65. CSA - CSA International; (Formerly: IAS - International Approval Services); [www.csa-international.org](http://www.csa-international.org).
66. CSI - Construction Specifications Institute (The); [www.csinet.org](http://www.csinet.org).
67. CSSB - Cedar Shake & Shingle Bureau; [www.cedarbureau.org](http://www.cedarbureau.org).
68. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); [www.cti.org](http://www.cti.org).
69. CWC - Composite Wood Council; (See CPA).
70. DASMA - Door and Access Systems Manufacturers Association; [www.dasma.com](http://www.dasma.com).
71. DHI - Door and Hardware Institute; [www.dhi.org](http://www.dhi.org).
72. ECA - Electronic Components Association; (See ECIA).
73. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
74. ECIA - Electronic Components Industry Association; [www.eciaonline.org](http://www.eciaonline.org).
75. EIA - Electronic Industries Alliance; (See TIA).
76. EIMA - EIFS Industry Members Association; [www.eima.com](http://www.eima.com).
77. EJMA - Expansion Joint Manufacturers Association, Inc.; [www.ejma.org](http://www.ejma.org).
78. ESD - ESD Association; (Electrostatic Discharge Association); [www.esda.org](http://www.esda.org).
79. ESTA - Entertainment Services and Technology Association; (See PLASA).
80. EVO - Efficiency Valuation Organization; [www.evo-world.org](http://www.evo-world.org).
81. FCI - Fluid Controls Institute; [www.fluidcontrolsinstitute.org](http://www.fluidcontrolsinstitute.org).
82. FED-STD - Federal Standard (See FS).
83. FM Approvals - FM Approvals LLC; [www.fmglobal.com](http://www.fmglobal.com).
84. FM Global - FM Global; (Formerly: FMG - FM Global); [www.fmglobal.com](http://www.fmglobal.com).

85. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; [www.floridarooft.com](http://www.floridarooft.com).
86. FSA - Fluid Sealing Association; [www.fluidsealing.com](http://www.fluidsealing.com).
87. FSC - Forest Stewardship Council U.S.; [www.fscus.org](http://www.fscus.org).
88. GA - Gypsum Association; [www.gypsum.org](http://www.gypsum.org).
89. GANA - Glass Association of North America; [www.glasswebsite.com](http://www.glasswebsite.com).
90. GS - Green Seal; [www.greenseal.org](http://www.greenseal.org).
91. HI - Hydraulic Institute; [www.pumps.org](http://www.pumps.org).
92. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
93. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
94. HPVA - Hardwood Plywood & Veneer Association; [www.hpva.org](http://www.hpva.org).
95. HPW - H. P. White Laboratory, Inc.; [www.hpwhite.com](http://www.hpwhite.com).
96. IAPSC - International Association of Professional Security Consultants; [www.iapsc.org](http://www.iapsc.org).
97. IAS - International Accreditation Service; [www.iasonline.org](http://www.iasonline.org).
98. IAS - International Approval Services; (See CSA).
99. ICBO - International Conference of Building Officials; (See ICC).
100. ICC - International Code Council; [www.iccsafe.org](http://www.iccsafe.org).
101. ICEA - Insulated Cable Engineers Association, Inc.; [www.icea.net](http://www.icea.net).
102. ICPA - International Cast Polymer Alliance; [www.icpa-hq.org](http://www.icpa-hq.org).
103. ICRI - International Concrete Repair Institute, Inc.; [www.icri.org](http://www.icri.org).
104. IEC - International Electrotechnical Commission; [www.iec.ch](http://www.iec.ch).
105. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); [www.ieee.org](http://www.ieee.org).
106. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); [www.ies.org](http://www.ies.org).
107. IESNA - Illuminating Engineering Society of North America; (See IES).
108. IEST - Institute of Environmental Sciences and Technology; [www.iest.org](http://www.iest.org).
109. IGMA - Insulating Glass Manufacturers Alliance; [www.igmaonline.org](http://www.igmaonline.org).
110. IGSHPA - International Ground Source Heat Pump Association; [www.igshpa.okstate.edu](http://www.igshpa.okstate.edu).
111. ILI - Indiana Limestone Institute of America, Inc.; [www.ili.ai.com](http://www.ili.ai.com).
112. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); [www.intertek.com](http://www.intertek.com).
113. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); [www.isa.org](http://www.isa.org).
114. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
115. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); [www.isfanow.org](http://www.isfanow.org).
116. ISO - International Organization for Standardization; [www.iso.org](http://www.iso.org).
117. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
118. ITU - International Telecommunication Union; [www.itu.int/home](http://www.itu.int/home).
119. KCMA - Kitchen Cabinet Manufacturers Association; [www.kcma.org](http://www.kcma.org).
120. LMA - Laminating Materials Association; (See CPA).
121. LPI - Lightning Protection Institute; [www.lightning.org](http://www.lightning.org).
122. MBMA - Metal Building Manufacturers Association; [www.mbma.com](http://www.mbma.com).
123. MCA - Metal Construction Association; [www.metalconstruction.org](http://www.metalconstruction.org).
124. MFMA - Maple Flooring Manufacturers Association, Inc.; [www.maplefloor.org](http://www.maplefloor.org).
125. MFMA - Metal Framing Manufacturers Association, Inc.; [www.metalframingmfg.org](http://www.metalframingmfg.org).
126. MHIA - Material Handling Industry of America; [www.mhia.org](http://www.mhia.org).



127. MIA - Marble Institute of America; [www.marble-institute.com](http://www.marble-institute.com).
128. MMPA - Moulding & Millwork Producers Association; [www.wmmpa.com](http://www.wmmpa.com).
129. MPI - Master Painters Institute; [www.paintinfo.com](http://www.paintinfo.com).
130. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; [www.mss-hq.org](http://www.mss-hq.org).
131. NAAMM - National Association of Architectural Metal Manufacturers; [www.naamm.org](http://www.naamm.org).
132. NACE - NACE International; (National Association of Corrosion Engineers International); [www.nace.org](http://www.nace.org).
133. NADCA - National Air Duct Cleaners Association; [www.nadca.com](http://www.nadca.com).
134. NAIMA - North American Insulation Manufacturers Association; [www.naima.org](http://www.naima.org).
135. NBGQA - National Building Granite Quarries Association, Inc.; [www.nbgqa.com](http://www.nbgqa.com).
136. NBI - New Buildings Institute; [www.newbuildings.org](http://www.newbuildings.org).
137. NCAA - National Collegiate Athletic Association (The); [www.ncaa.org](http://www.ncaa.org).
138. NCMA - National Concrete Masonry Association; [www.ncma.org](http://www.ncma.org).
139. NEBB - National Environmental Balancing Bureau; [www.nebb.org](http://www.nebb.org).
140. NECA - National Electrical Contractors Association; [www.necanet.org](http://www.necanet.org).
141. NeLMA - Northeastern Lumber Manufacturers Association; [www.nelma.org](http://www.nelma.org).
142. NEMA - National Electrical Manufacturers Association; [www.nema.org](http://www.nema.org).
143. NETA - InterNational Electrical Testing Association; [www.netaworld.org](http://www.netaworld.org).
144. NFHS - National Federation of State High School Associations; [www.nfhs.org](http://www.nfhs.org).
145. NFPA - National Fire Protection Association; [www.nfpa.org](http://www.nfpa.org).
146. NFPA - NFPA International; (See NFPA).
147. NFRC - National Fenestration Rating Council; [www.nfrc.org](http://www.nfrc.org).
148. NHLA - National Hardwood Lumber Association; [www.nhla.com](http://www.nhla.com).
149. NLGA - National Lumber Grades Authority; [www.nlga.org](http://www.nlga.org).
150. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
151. NOMMA - National Ornamental & Miscellaneous Metals Association; [www.nomma.org](http://www.nomma.org).
152. NRCA - National Roofing Contractors Association; [www.nrca.net](http://www.nrca.net).
153. NRMCA - National Ready Mixed Concrete Association; [www.nrmca.org](http://www.nrmca.org).
154. NSF - NSF International; [www.nsf.org](http://www.nsf.org).
155. NSPE - National Society of Professional Engineers; [www.nspe.org](http://www.nspe.org).
156. NSSGA - National Stone, Sand & Gravel Association; [www.nssga.org](http://www.nssga.org).
157. NTMA - National Terrazzo & Mosaic Association, Inc. (The); [www.ntma.com](http://www.ntma.com).
158. NWFA - National Wood Flooring Association; [www.nwfa.org](http://www.nwfa.org).
159. PCI - Precast/Prestressed Concrete Institute; [www.pci.org](http://www.pci.org).
160. PDI - Plumbing & Drainage Institute; [www.pdionline.org](http://www.pdionline.org).
161. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); [www.plasa.org](http://www.plasa.org).
162. RCSC - Research Council on Structural Connections; [www.boltcouncil.org](http://www.boltcouncil.org).
163. RFCI - Resilient Floor Covering Institute; [www.rfci.com](http://www.rfci.com).
164. RIS - Redwood Inspection Service; [www.redwoodinspection.com](http://www.redwoodinspection.com).
165. SAE - SAE International; [www.sae.org](http://www.sae.org).
166. SCTE - Society of Cable Telecommunications Engineers; [www.scte.org](http://www.scte.org).
167. SDI - Steel Deck Institute; [www.sdi.org](http://www.sdi.org).
168. SDI - Steel Door Institute; [www.steeldoor.org](http://www.steeldoor.org).
169. SEFA - Scientific Equipment and Furniture Association (The); [www.sefalabs.com](http://www.sefalabs.com).
170. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).



171. SIA - Security Industry Association; [www.siaonline.org](http://www.siaonline.org).
172. SJI - Steel Joist Institute; [www.steeljoist.org](http://www.steeljoist.org).
173. SMA - Screen Manufacturers Association; [www.smainfo.org](http://www.smainfo.org).
174. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; [www.smacna.org](http://www.smacna.org).
175. SMPTE - Society of Motion Picture and Television Engineers; [www.smpte.org](http://www.smpte.org).
176. SPFA - Spray Polyurethane Foam Alliance; [www.sprayfoam.org](http://www.sprayfoam.org).
177. SPIB - Southern Pine Inspection Bureau; [www.spib.org](http://www.spib.org).
178. SPRI - Single Ply Roofing Industry; [www.spri.org](http://www.spri.org).
179. SRCC - Solar Rating & Certification Corporation; [www.solar-rating.org](http://www.solar-rating.org).
180. SSINA - Specialty Steel Industry of North America; [www.ssina.com](http://www.ssina.com).
181. SSPC - SSPC: The Society for Protective Coatings; [www.sspc.org](http://www.sspc.org).
182. STI - Steel Tank Institute; [www.steeltank.com](http://www.steeltank.com).
183. SWI - Steel Window Institute; [www.steelwindows.com](http://www.steelwindows.com).
184. SWPA - Submersible Wastewater Pump Association; [www.swpa.org](http://www.swpa.org).
185. TCA - Tilt-Up Concrete Association; [www.tilt-up.org](http://www.tilt-up.org).
186. TCNA - Tile Council of North America, Inc.; [www.tileusa.com](http://www.tileusa.com).
187. TEMA - Tubular Exchanger Manufacturers Association, Inc.; [www.tema.org](http://www.tema.org).
188. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); [www.tiaonline.org](http://www.tiaonline.org).
189. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
190. TMS - The Masonry Society; [www.masonrysociety.org](http://www.masonrysociety.org).
191. TPI - Truss Plate Institute; [www.tpinst.org](http://www.tpinst.org).
192. TPI - Turfgrass Producers International; [www.turfgrasssod.org](http://www.turfgrasssod.org).
193. TRI - Tile Roofing Institute; [www.tilerroofing.org](http://www.tilerroofing.org).
194. UL - Underwriters Laboratories Inc.; [www.ul.com](http://www.ul.com).
195. UNI - Uni-Bell PVC Pipe Association; [www.uni-bell.org](http://www.uni-bell.org).
196. USAV - USA Volleyball; [www.usavolleyball.org](http://www.usavolleyball.org).
197. USGBC - U.S. Green Building Council; [www.usgbc.org](http://www.usgbc.org).
198. USITT - United States Institute for Theatre Technology, Inc.; [www.usitt.org](http://www.usitt.org).
199. WASTEC - Waste Equipment Technology Association; [www.wastec.org](http://www.wastec.org).
200. WCLIB - West Coast Lumber Inspection Bureau; [www.wclib.org](http://www.wclib.org).
201. WCMA - Window Covering Manufacturers Association; [www.wcmanet.org](http://www.wcmanet.org).
202. WDMA - Window & Door Manufacturers Association; [www.wdma.com](http://www.wdma.com).
203. WI - Woodwork Institute; [www.wicnet.org](http://www.wicnet.org).
204. WSRCA - Western States Roofing Contractors Association; [www.wsrca.com](http://www.wsrca.com).
205. WWPA - Western Wood Products Association; [www.wwpa.org](http://www.wwpa.org).

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. IAPMO - International Association of Plumbing and Mechanical Officials; [www.iapmo.org](http://www.iapmo.org).
2. ICC - International Code Council; [www.iccsafe.org](http://www.iccsafe.org).
3. ICC-ES - ICC Evaluation Service, LLC; [www.icc-es.org](http://www.icc-es.org).

- C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.

1. COE - Army Corps of Engineers; [www.usace.army.mil](http://www.usace.army.mil).
2. CPSC - Consumer Product Safety Commission; [www.cpsc.gov](http://www.cpsc.gov).
3. DOC - Department of Commerce; National Institute of Standards and Technology; [www.nist.gov](http://www.nist.gov).
4. DOD - Department of Defense; [www.quicksearch.dla.mil](http://www.quicksearch.dla.mil).
5. DOE - Department of Energy; [www.energy.gov](http://www.energy.gov).
6. EPA - Environmental Protection Agency; [www.epa.gov](http://www.epa.gov).
7. FAA - Federal Aviation Administration; [www.faa.gov](http://www.faa.gov).
8. FG - Federal Government Publications; [www.gpo.gov](http://www.gpo.gov).
9. GSA - General Services Administration; [www.gsa.gov](http://www.gsa.gov).
10. HUD - Department of Housing and Urban Development; [www.hud.gov](http://www.hud.gov).
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; [www.eetd.lbl.gov](http://www.eetd.lbl.gov).
12. OSHA - Occupational Safety & Health Administration; [www.osha.gov](http://www.osha.gov).
13. SD - Department of State; [www.state.gov](http://www.state.gov).
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; [www.trb.org](http://www.trb.org).
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; [www.ars.usda.gov](http://www.ars.usda.gov).
16. USDA - Department of Agriculture; Rural Utilities Service; [www.usda.gov](http://www.usda.gov).
17. USDJ - Department of Justice; Office of Justice Programs; National Institute of Justice; [www.ojp.usdoj.gov](http://www.ojp.usdoj.gov).
18. USP - U.S. Pharmacopeial Convention; [www.usp.org](http://www.usp.org).
19. USPS - United States Postal Service; [www.usps.com](http://www.usps.com).

- D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. ADA - Americans with Disabilities Act; [www.ada.gov](http://www.ada.gov). CFR - Code of Federal Regulations; [www.ecfr.com](http://www.ecfr.com).
2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; [www.quicksearch.dla.mil](http://www.quicksearch.dla.mil).
3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).
5. FTMS - Federal Test Method Standard (See FS).
6. FS - Federal Specification; Available from DLA Document Services; [www.quicksearch.dla.mil](http://www.quicksearch.dla.mil).
  - a. Available from Defense Standardization Program; [www.dsp.dla.mil](http://www.dsp.dla.mil).
  - b. Available from General Services Administration; [www.gsa.gov](http://www.gsa.gov).
  - c. Available from National Institute of Building Sciences/Whole Building Design Guide; [www.wbdg.org/ccb](http://www.wbdg.org/ccb).
7. MILSPEC - Military Specification and Standards; (See DOD).

8. USAB - United States Access Board; [www.access-board.gov](http://www.access-board.gov).
  9. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).
- E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; [www.bearhfti.ca.gov](http://www.bearhfti.ca.gov).
  2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; [www.calregs.com](http://www.calregs.com).
  3. CDHS; California Department of Health Services; (See CDPH).
  4. CDPH; California Department of Public Health; Indoor Air Quality Program; [www.cal-iaq.org](http://www.cal-iaq.org).
  5. CPUC; California Public Utilities Commission; [www.cpuc.ca.gov](http://www.cpuc.ca.gov).
  6. SCAQMD; South Coast Air Quality Management District; [www.aqmd.gov](http://www.aqmd.gov).
  7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; [www.txforestsERVICE.tamu.edu](http://www.txforestsERVICE.tamu.edu).

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

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## SECTION 014525 - STRUCTURAL INSPECTIONS

## PART 1 -GENERAL

## 1.1 SECTION INCLUDES

- A. Section summarizes the responsibility of the Contractor and the Structural Testing/Inspection Agency in the performance of the testing/inspection specified in the Contract Documents.
- B. Neither the observation of the Design Professional in the administration of the contract, nor tests/inspections by the Testing/Inspection Agency, nor approvals by persons other than the Design Professional shall relieve the Contractor from his obligation to perform the work in accordance with the Contract Documents.

## 1.2 RELATED SECTIONS

- A. Section 013330 - Structural Submittals
- B. Section 014000 - Quality Control Services

## 1.3 REFERENCES

- A. ASTM D3740 - Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- B. ASTM E329 - Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.
- C. American Council of Independent Laboratories - Recommended Requirements for Independent Laboratories Qualifications.

## 1.4 SELECTION AND PAYMENT

- A. Owner will employ and pay for the structural testing/inspection services that are required by the Contract Documents.
- B. Contractor shall pay for any additional structural testing/inspection required for work or materials not complying with Contract Documents due to negligence or non- conformance.
- C. Contractor shall pay for any additional structural testing/inspection required for his convenience.
- D. Qualifications: Minimum Special Inspector qualifications shall be per Chapter 17 of the International Building Code 2015 Edition.

## 1.5 STRUCTURAL TESTING/INSPECTION REQUIREMENT SUMMARY

- A. Specific structural testing/inspection requirements are given in the following specification sections:

Specification 03 3100	Concrete Formwork Inspection
Specification 03 2000	Concrete Reinforcement Inspection
Specification 03 3000	Concrete Testing/Inspection
Specification 03 6200	Non-Shrink Grout Inspection
Specification 05 1000	Structural Steel Inspection

## 1.6 STATEMENT OF SPECIAL INSPECTIONS

- A. Provide testing/inspection required to meet the provisions of the Schedule of Special Inspection Services below.

2: MATERIALS (Not Used)

3: EXECUTION (Not Used)

## 3.1 STRUCTURAL PRECONSTRUCTION MEETING

- A. A structural preconstruction meeting may be conducted at the construction site by the Design Professional to discuss quality issues. The parties involved may be the Design Professional, Contractor, Structural Testing/Inspection Agency, appropriate subcontractors, suppliers, and detailers.

## 3.2 STRUCTURAL TESTING/INSPECTION AGENCY'S RESPONSIBILITIES

- A. Cooperate with the Contractor and provide timely service.
- B. Upon arriving at the construction site, sign in and notify the Contractor of presence.
- C. Select the representative samples that are to be tested/inspected.
- D. Perform tests/inspections as outlined in Contract Documents, the applicable codes, and as directed by the Design Professional.
- E. Report work and materials not complying with Contract Documents immediately to the Contractor and Design Professional.
- F. Leave copies of field notes with the Contractor prior to leaving the construction site. Field notes shall include the message given to the Contractor, date, time of message, name of Contractor's representative informed, type and location of work or materials tested/inspected, whether the work or materials complies with Contract Documents and name of the Structural Testing/Inspection Agency's representative.

- G. Report and distribute results of tests/inspections promptly in the form of written reports as directed by the Design Professional.
- H. Structural Testing/Inspection Agency shall not alter requirements of Contract Documents, approve or reject any portion of the work, or perform duties of the Contractor.

### 3.3 CONTRACTOR'S RESPONSIBILITIES

- A. Provide copy of Contract Documents to the Structural Testing/Inspection Agency.
- B. Arrange the preconstruction meeting to discuss quality issues.
- C. Notify the Structural Testing/Inspection Agency sufficiently in advance of operations to allow assignment of personnel and scheduling of tests.
- D. Cooperate with Structural Testing/Inspection Agency and provide access to work.
- E. Provide samples of materials to be tested in required quantities.
- F. Furnish copies of mill test reports when requested
- G. Provide storage space for Structural Testing/Inspection Agency's exclusive use, such as for storing and curing concrete testing samples.
- H. Provide labor to assist the Structural Testing/Inspection Agency in performing tests/ inspections.

### 3.4 OPTIONS

- A. If the Structural Testing/Inspection Agency is located at such a distance from the project that travel expenses will be a consideration, or if the amount of sampling performed is minor, and by mutual agreement of the Design Professional and Contractor, the Contractor may be requested to take samples and forward them to the Structural Testing/Inspection Agency for testing/inspection.

END OF SECTION

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## SECTION 014533 - STRUCTURAL TESTING AND SPECIAL INSPECTION SERVICES

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section summarizes the responsibility of the Contractor and the Testing/Inspection Agency in the performance of the testing/inspection specified in the Contract Documents.
- B. Neither the observations of the Architect in the administration of the contract, nor tests/inspections by the Testing/Inspection Agency, nor approvals by persons other than the Architect shall relieve the Contractor from his obligation to perform the work in accordance with the Contract Documents.
- C. Special Inspection reports and a final report in accordance with Section 1704.2.4 of the 2018 International Building Code shall be submitted to the Building Official prior to the time that phase of work is approved for occupancy.

## 1.2 REFERENCES

- A. ASTM D3740 - Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- B. ASTM E329 - Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.
- C. American Council of Independent Laboratories - Recommended Requirements for Independent Laboratories Qualifications.

## 1.3 SELECTION AND PAYMENT

- A. The Owner will select the Testing/Inspection Agency and will pay for the structural testing and special inspection services that are required by the Contract Documents.
- B. Contractor shall pay for any additional structural testing/inspection required for work or materials not complying with Contract Documents due to negligence or nonconformance.
- C. Contractor shall pay for any additional structural testing/inspection required for his convenience.

## 1.4 SUBMITTALS

- A. Completed Contractor's Statement of Responsibility



B. Submit Certificates of Compliance for the following:

1. Structural steel.
2. Steel joists.

1.5 QUALITY ASSURANCE

- A. Testing/Inspection Agency Qualifications: In accordance with the Minimum Special Inspector Qualifications Table and identified on the “List of Eligible Firms” maintained by the Georgia State Financing and Investment Commission.

1.6 STRUCTURAL TESTING AND SPECIAL INSPECTION REQUIRED FORMS

- A. Specific structural testing and special inspection forms are included in this specification section as follows:
1. Minimum Special Inspector Qualifications Table
  2. Statement of Special Inspections
  3. Special Inspections for Seismic Resistance
  4. Special Inspections for Wind Resistance
  5. Schedule of Special Inspections Services
  6. Contractor’s Statement of Responsibility
  7. Fabricator Certificate of Compliance
  8. Final Report of Special Inspections

PART 2 - MATERIALS

-- NOT USED --

PART 3 - EXECUTION

3.1 STRUCTURAL PRECONSTRUCTION MEETING

- A. A structural preconstruction meeting may be conducted at the construction site by the Architect to discuss quality issues. The parties involved may be the Architect, Structural Engineer, Contractor, Structural Testing/Inspection Agency, appropriate subcontractors, suppliers, and detailers.

3.2 STRUCTURAL TESTING/INSPECTION AGENCY'S RESPONSIBILITIES

- A. Cooperate with the Contractor and provide timely service.
- B. Upon arriving at the construction site, sign in and notify the Contractor of presence.
- C. Select the representative samples that are to be tested/inspected.
- D. Perform tests/inspections as outlined in Contract Documents, the applicable code referenced standards, and as directed by the Architect.

- E. Report work and materials not complying with Contract Documents immediately to the Contractor and Architect.
- F. Leave copies of field notes with the Contractor prior to leaving the construction site. Field notes shall include the message given to the Contractor, date, time of message, name of Contractor's representative informed, type and location of work or materials tested/inspected, whether the work or materials complies with Contract Documents and name of the Structural Testing/Inspection Agency's representative.
- G. Report and distribute results of tests/inspections promptly in the form of written reports as directed by the Architect.
- H. Promptly report any non-conforming work in separate discrepancy reports indicating description, location, reference to applicable Contract Documents, resolution or corrective action taken and date.
- I. Structural Testing/Inspection Agency shall not alter requirements of Contract Documents, approve or reject any portion of the work, or perform duties of the Contractor.
- J. Initial and date the "Date Completed" box in the Schedule of Special Inspections as the inspection and testing activities are completed.
- K. Submit a completed Final Report of Special Inspections at the completion of the special inspection activities.

### 3.3 CONTRACTOR'S RESPONSIBILITIES

- A. Provide copy of Contract Documents to the Structural Testing/Inspection Agency.
- B. Submit completed Contractor's Statement of Responsibility.
- C. Arrange the preconstruction meeting to discuss quality issues.
- D. Notify the Structural Testing/Inspection Agency 48 hours in advance of operations to allow assignment of personnel and scheduling of tests.
- E. Cooperate with Structural Testing/Inspection Agency and provide access to work.
- F. Provide samples of materials to be tested in required quantities.
- G. Furnish copies of mill test reports when requested.
- H. Provide storage space for Structural Testing/Inspection Agency's exclusive use, such as for storing and curing concrete testing samples.
- I. Provide labor to assist the Structural Testing/Inspection Agency in performing tests/inspections.

END OF SECTION 014533

**MINIMUM SPECIAL INSPECTOR QUALIFICATIONS**

Category of Testing and Inspection	Minimum Qualifications (refer to key at end of Table)		
	Shop Testing or Inspection	Field Testing or Inspection	Review Testing, Certification, & Lab Reports
<b>1704.2.5 Inspection of Fabricators</b>			
1. Pre-cast concrete	A, C, E		
2. Structural steel construction	C, F, G		
3. Wood construction	A		
4. Cold formed metal construction	A		
<b>1705.2, 1705.10, 1705.11&amp; 1705.12 Steel Construction</b>			
1. Verification of welding consumables, filler metals, procedure specifications, procedure qualification records and personnel performance qualification records			C, F
2. Nondestructive testing of welding	G	G	
3. Inspection of welding	C, F	C, F	
4. Verification of fabricator and erector documents as listed in AISC 360, chapter N, paragraph 3.2			A, C
5. Material verification of weld filler materials			C, F
6. Inspection of high strength bolting and steel frame joint details		A, C	
7. Inspection of embedments and erection of fabricated steel and steel frame elements		A, C, F	
8. Inspection of steel elements of composite construction		A, C, F	
9. Verification of reinforcing steel, cold formed steel deck and truss materials			A, C, F
10. Inspection of reinforcing steel, cold formed steel deck and trusses		A, C	
<b>1705.3 &amp; 1705.12 Concrete Construction</b>			
1. Reinforcing placement, cast-in-place bolts, post installed anchors concrete and shotcrete placement and curing operations. Inspection of formwork for shape, location and dimensions		A, C, H	
2. Pre-stressing steel installation		A, C, D, E	
3. Erection of pre-cast concrete members		A, C, H	
4. Concrete field sampling and testing		J	
5. Concrete strength testing		P	
6. Review certified mill reports			A, C
7. Verify use of required design mix		A, I, J, H, C	
8. Pre-stressed (pre-tensioned) concrete force application	A, C, E		
9. Post-tensioned concrete force application		A, C, D	
10. Review of in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs		A, C, D, H	
11. Reinforcing steel weldability, reinforcing welding, weld filler material		C, F	
12. Testing of welding of reinforcing steel		G	

(Minimum Special Inspector Qualifications Continued)			
Category of Testing and Inspection	Minimum Qualifications (refer to key at end of Table)		
	Shop Testing or Inspection	Field Testing or Inspection	Review Testing, Certification, & Lab Reports
<b>1705.4 Masonry</b>			
1. Verification of $f'_m$ and $f'_{AAC}$		A, C, L, M	
2. Mortar joint construction, grout protection and placement, materials proportion, type/size/location of reinforcement, structural elements, anchorage, and connectors		A, C, K	
3. Sampling/testing of grout/mortar specimens		A, C, L, M	
4. Observe preparation of masonry prisms for testing of compressive strength of masonry, $f'_m$ and $f'_{AAC}$		A, C, K, L, M	
5. Inspection of welding of reinforcing steel		C, F	
6. Testing of welding of reinforcing steel		G	
<b>1705.6&amp; 1804 Soils</b>			
1. Observe site preparation, fill placement testing of compaction for compliance with the construction documents for the project		A, C, I, N	
2. Observe test bearing materials below shallow foundations for ability to achieve design bearing capacity		A, C, N, I (Level III)	
3. Review compaction testing for compliance with the construction documents for the project			A
<b>1705.5, 1705.10, 1705.11 &amp; 1705.12 Wood Construction</b>			
1. Observe structural panel sheathing, size of framing members, nail or staple diameter and length, number of fastener lines, and spacing of fastener lines and fasteners for compliance with construction documents for the project		A	
2. Observe temporary and permanent truss member restraint/bracing, field gluing of elements. Observe bolting, anchoring or other fastening of: shear walls, diaphragms, drag struts, braces and hold-downs.		A	
<b>1705.7, 1705.8, 1705.9 &amp; 1810 Pile and Pier Foundations</b>			
1. Observe installation		A, N	
2. Observe load tests		A	
<b>1705.13 Sprayed Fire-Resistant Materials</b>			
1. Observe surface conditions, application, average thickness and density of applied material, and cohesive/adhesive bond		A, C	
<b>1705.14 Mastic and Intumescent Fire-Resistant Coatings</b>			
1. Observe application compliance with AWCI 12-B		A, C	
<b>1705.15 Exterior Insulation and Finish Systems</b>			
1. Inspect EIFS systems		A, B, C, O	
<b>1705.1 Special Cases</b>			
1. Work of unusual or special nature		A, B, O	
<b>1705.16 Fire-Resistant Penetrations and Joints</b>	See Requirements of IBC Sections 1705.16.1 and 1705.16.2		
<b>1705.17 Smoke Control</b>	See Requirements of IBC Section .1705.17.2		

(Minimum Special Inspector Qualifications Continued)			
Category of Testing and Inspection	Minimum Qualifications (refer to key at end of Table)		
	Shop Testing or Inspection	Field Testing or Inspection	Review Testing, Certification, & Lab Reports
<b>1705.10, 1705.11, 1705.12, Seismic and Wind Resistance</b>			
1. Periodic inspection of fabrication, installation and/or anchorage of building systems and components		A	
<p><b>KEY:</b></p> <ul style="list-style-type: none"> <li>A. Georgia Professional Engineer (GA PE) competent in the specific task area or graduate of accredited engineering/engineering technology program under the direct supervision of a GA PE.</li> <li>B. Georgia Registered Architect (GA RA) or graduate of accredited architecture/architecture technology program under the direction of a GA RA.</li> <li>C. International Code Council (ICC) Special Inspector Certification specific to the particular material and testing methodology applicable to each Category of Testing and Inspection listed in the table.</li> <li>D. Post-tensioning Institute (PTI) Certification, Level 2, bonded or unbonded as applicable.</li> <li>E. Pre-stressed Concrete Institute (PCI) Certified Inspector.</li> <li>F. American Welding Society (AWS) Certified Welding Inspector (CWI) or AWS Certified Associate Welding Inspector working under the direct on-site supervision of a CWI.</li> <li>G. American Society for Nondestructive Testing (ASNT) Level II certification, or a Level III certification if previously certified as a Level II in the particular material and testing methodology applicable to each Category of Testing and Inspection listed in the table.</li> <li>H. American Concrete Institute (ACI) Concrete Construction Special Inspector.</li> <li>I. National Institute for Certification in Engineering Technologies (NICET) Level II or higher certification specific to the particular material and testing methodology applicable to each Category of Testing and Inspection listed in the table.</li> <li>J. ACI Concrete Field Testing Technician with Grade 1 certification.</li> <li>K. Georgia Concrete and Products Association (GC&amp;PA) – Masonry Association of Georgia (MAG) Masonry Construction Inspector Certification.</li> <li>L. National Concrete Masonry Association (NCMA) Concrete Masonry Testing Procedures certification.</li> <li>M. GC&amp;PA – MAG Masonry Testing Technician certification.</li> <li>N. NICET Certified Engineering Technologist (CT).</li> <li>O. Other Qualified Special Inspector as approved by the Building Official.</li> <li>P. American Concrete Institute (ACI) Strength Testing Technician.</li> </ul> <p><b>Notes:</b></p> <ul style="list-style-type: none"> <li>1. <i>The Special Inspector shall meet one of the minimum qualifications listed for the applicable Category of Testing and Inspection.</i></li> <li>2. <i>Materials testing shall be done by an Approved Testing Agency meeting the requirements of IBC Section 1703 and ASTM E 329.</i></li> </ul>			

**STATEMENT OF SPECIAL INSPECTIONS****PROJECT:** Halcyon Village Building #1300**LOCATION:** \_\_\_\_\_**PERMIT APPLICANT:** \_\_\_\_\_**APPLICANT'S ADDRESS:** \_\_\_\_\_**ARCHITECT OF RECORD:** \_\_\_\_\_**STRUCTURAL ENGINEER OF RECORD:** James A. Jones, Uzun+ Case, LLC**REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE:** \_\_\_\_\_

This Statement of Special Inspections is submitted in accordance with Section 1704.3 of the 2018 International Building Code. It includes a *Schedule of Special Inspection Services* applicable to the above-referenced Project as well as the identity of the individuals, agencies, or firms intended to be retained for conducting these inspections. If applicable, it includes *Special Inspections for Seismic Resistance* and/or *Special Inspections for Wind Resistance*.

Are *Special Inspections for Seismic Resistance* included in the *Statement of Special Inspections*? ☒ Yes ☐ No

Are *Special Inspections for Wind Resistance* included in the *Statement of Special Inspections*? ☒ Yes ☐ No

The Special Inspector(s) shall keep records of all inspections and shall furnish interim inspection reports to the Building Official and to the Registered Design Professional in Responsible Charge at a frequency agreed upon by the Design Professional and the Building Official prior to the start of work. Discrepancies shall be brought to the immediate attention of the Contractor for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of the Building Official and the Registered Design Professional in Responsible Charge prior to completion of that phase of work. A *Final Report of Special Inspections* documenting required special inspections and corrections of any discrepancies noted in the inspections shall be submitted to the Building Official and the Registered Design Professional in Responsible Charge at the conclusion of the project.

Frequency of interim report submittals to the Registered Design Professional in Responsible Charge:

X  Weekly        Bi-Weekly        Monthly      Other; specify: \_\_\_\_\_

The Special Inspection program does not relieve the Contractor of the responsibility to comply with the Contract Documents. Jobsite safety and means and methods of construction are solely the responsibility of the Contractor.

Statement of Special Inspections Prepared by:

\_\_\_\_\_  
Type or print name

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

Preparer's Seal

**SPECIAL INSPECTIONS FOR SEISMIC RESISTANCE**

See the Schedule of Special Inspections for inspection and testing requirements

**Seismic Design Category:** C

**Special Inspections for Seismic Resistance Required (Yes/No):** Yes

**Description of seismic force-resisting system subject to special inspection and testing for seismic resistance:**

(Where required per IBC Sections 1705.12.1, 1705.12.2, and 1705.12.3) (Special inspections for seismic resistance of structural steel, where required, shall be in accordance with AISC 341)

**Description of designated seismic systems subject to special inspection and testing for seismic resistance:**

(Required for architectural, electrical and mechanical systems and their components that require design in accordance with Chapter 13 of ASCE 7, have a component importance factor,  $I_p$ , greater than one and are in Seismic Design Categories C, D, E or F.)

- Review of Certificates of Compliance for Lay-in Panel Ceilings.

**Description of additional seismic systems and components requiring special inspections:**

(Required for systems noted in IBC Section 1705.12.5, 1705.12.6, 1705.12.7, and 1705.12.8.)

**Description of additional seismic systems and components requiring testing:**

(Where required per IBC Section 1705.13)

**Statement of Responsibility:**

Each contractor responsible for the construction or fabrication of a system or component described above must submit a Statement of Responsibility.

**SPECIAL INSPECTIONS FOR WIND RESISTANCE**

See the Schedule of Special Inspections for inspection and testing requirements

**Allowable Stress Design Wind Speed,  $V_{asd}$  :** 63 m.p.h.

**Wind Exposure Category:** C

**Special Inspection for Wind Resistance Required (Yes/No):** No

(Required in wind exposure Category B, where the allowable stress design wind speed,  $V_{asd}$ , is 120 miles per hour or greater. Required in wind exposure Category C or D, where the allowable stress design wind speed,  $V_{asd}$ , is 110 miles per hour or greater).

**Description of structural wood and cold-formed steel light frame construction main windforce-resisting system subject to special inspection for wind resistance:**

(Required for systems noted in IBC Section 1705.11.1 and 1705.11.2).

**Description of windforce-resisting system subject to special inspection for wind resistance:**

(Required for systems noted in IBC Section 1705.11.3)

**Statement of Responsibility:**

Each contractor responsible for the construction or fabrication of a system or component described above must submit a Statement of Responsibility



**SCHEDULE OF SPECIAL INSPECTIONS**

MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
1705.1.1 Special Cases					
1. Inspection of anchors post-installed in solid grouted masonry: Per research reports including verification of anchor type, anchor dimensions, hole dimensions, hole cleaning procedures, anchor spacing, edge distances, masonry unit, grout, masonry compressive strength, anchor embedment and tightening torque	Field inspection	Y	Field inspection	1	
1705.2.1 Steel Construction					
1. Fabricator and erector documents (Verify reports and certificates as listed in AISC 360, Section N 3.2, for compliance with construction documents)	Submittal Review	Y	Each submittal	1	
2. Material verification of structural steel	Shop (3) and field inspection	Y	Periodic	1	
3. Structural steel welding:					
a. Inspection tasks Prior to Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 360, Table N5.4-1)	Shop (3) and field inspection	Y	Observe or Perform as noted (4)	1	
b. Inspection tasks During Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 360, Table N5.4-2)	Shop (3) and field inspection	Y	Observe (4)	1	
c. Inspection tasks After Welding (Observe, or perform for each welded joint or member, the QA tasks listed in AISC 360, Table N5.4-3)	Shop (3) and field inspection	Y	Observe or Perform as noted (4)	1	
d. Nondestructive testing (NDT) of welded joints:					
1) Complete penetration groove welds 5/16" or greater in risk category II, III or IV	Shop (3) or field ultrasonic testing - 100%	Y	Periodic	1	
2) Welded joints subject to fatigue when required by AISC 360, Appendix 3, Table A-3.1	Shop (3) or field radiographic or Ultrasonic testing	Y	Periodic	1	

(Schedule of Special Inspections Continued)					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
3) Fabricator's NDT reports when fabricator performs NDT	Verify reports	Y	Each submittal (5)	1	
4. Structural steel bolting:	Shop (3) and field inspection				
a. Inspection tasks Prior to Bolting (Observe, or perform tasks for each bolted connection, in accordance with QA tasks listed in AISC 360, Table N5.6-1)		Y	Observe or Perform as noted (4)	1	
b. Inspection tasks During Bolting (Observe the QA tasks listed in AISC 360, Table N5.6-2)		Y	Observe (4)	1	
1) Pre-tensioned and slip-critical joints					
a) Turn-of-nut with matching markings		N	Periodic		
b) Direct tension indicator		Y	Periodic	1	
c) Twist-off type tension control bolt		Y	Periodic	1	
d) Turn-of-nut without matching markings		N	Continuous		
e) Calibrated wrench		N	Continuous		
2) Snug-tight joints		N	Periodic		
c. Inspection tasks After Bolting (Perform tasks for each bolted connection in accordance with QA tasks listed in AISC 360, Table N5.6-3)		Y	Perform (4)	1	
5. Visual inspection of exposed cut surfaces of galvanized structural steel main members and exposed corners of the rectangular HSS for cracks subsequent to galvanizing	Shop (3) or field inspection	Y	Periodic	1	
6. Embedments (Verify diameter, grade, type, length, embedment. See 1705.3 for anchors)	Field inspection	Y	Periodic	1	
7. Verify member locations, braces, stiffeners, and application of joint details at each connection comply with construction documents	Field inspection	Y	Periodic	1	
<b>1705.2.2 Cold-Formed Steel Deck</b>					

(Schedule of Special Inspections Continued)					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
1. Manufacturer documents (Verify reports and certificates as listed in SDI QA/QC, Section 2, Paragraphs 2.1 and 2.2 for compliance with construction documents)	Submittal Review	Y	Each submittal	1	
2. Material verification of steel deck, mechanical fasteners and welding materials	Shop (3) and field inspection	Y	Periodic	1	
3. Cold-formed steel deck placement:	Shop (3) and field inspection				
a. Inspection tasks Prior to Deck Placement (Perform the QA tasks listed in SDI QA/QC, Appendix 1 Table 1.1)		Y	Perform (4)	1	
b. Inspection tasks After Deck Placement (Perform the QA tasks listed in SDI QA/QC, Appendix 1 Table 1.2)		Y	Perform (4)	1	
4. Cold-formed steel deck welding:	Shop (3) and field inspection				
a. Inspection tasks Prior to Welding (Observe the QA tasks listed in SDI QA/QC, Appendix 1 Table 1.3)		Y	Observe (4)	1	
b. Inspection tasks During Welding (Observe the QA tasks listed in SDI QA/QC, Appendix 1 Table 1.4)		Y	Observe (4)	1	
c. Inspection tasks After Welding (Perform the QA tasks listed in SDI QA/QC, Appendix 1 Table 1.5)		Y	Perform (4)	1	
5. Cold-formed steel deck mechanical fastening:	Shop (3) and field inspection				
a. Inspection tasks Prior to Mechanical Fastening (Observe the QA tasks listed in SDI QA/QC, Appendix 1 Table 1.6)		Y	Observe (4)	1	
b. Inspection tasks During Mechanical Fastening (Observe the QA tasks listed in SDI QA/QC, Appendix 1 Table 1.7)		Y	Observe (4)	1	
c. Inspection tasks After Mechanical Fastening (Perform the QA tasks listed in SDI QA/QC, Appendix 1 Table 1.8)		Y	Perform (4)	1	
<b>1705.2.3 Open-Web Steel Joists and Joist Girders</b>					
1. Installation of open-web steel joists and joist girders.					
a. End connections - welding or bolted.	per SJI CJ or SJI 100	Y	Periodic	1	

(Schedule of Special Inspections Continued)					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
b. Bridging - horizontal or diagonal.					
1) Standard bridging.	per SJI CJ or SJI 100	Y	Periodic	1	
2) Bridging that differs from the specifications listed in SJI CJ or SJI 100.		Y	Periodic	1	
<b>1705.2.4 Cold-Formed Trusses Spanning 60 feet or Greater</b>					
1. Verify temporary and permanent restraint/bracing are installed in accordance with the approved truss submittal package	Field inspection	N	Periodic		
<b>1705.3 Concrete Construction</b>					
1. Inspection and placement verification of reinforcing steel and prestressing tendons.	Shop (3) and field inspection	Y	Periodic	1	
2. Reinforcing bar welding:					
a. Verification of weldability of bars other than ASTM A706.		Y	Periodic	1	
b. Inspection of single-pass fillet welds 5/16 or less in size.		Y	Periodic	1	
c. Inspection of all other welds.		Y	Continuous	1	
3. Inspection of anchors cast in concrete.	Shop (3) and field inspection	Y	Periodic	1	
4. Inspection of anchors and reinforcing steel post-installed in hardened concrete members per research reports, or, if no specific requirements are provided, requirements shall be provided by the Architect and approved by the Building Official, including verification of anchor type, anchor dimensions, hole dimensions, hole cleaning procedures, anchor spacing, edge distances, concrete minimum thickness, anchor embedment and tightening torque	Field inspection	Y	Periodic or as required by the research report issued by an approved source	1	
a. Adhesive anchors installed in horizontal or upward-inclined orientation that resist sustained tension loads.		Y	Continuous	1	
b. Mechanical and adhesive anchors not defined in 4a.		Y	Periodic	1	
5. Verify use of approved design mix	Shop (3) and field inspection	Y	Periodic	1	

(Schedule of Special Inspections Continued)					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
6. Prior to placement, fresh concrete sampling, perform slump and air content tests and determine temperature of concrete and perform any other tests as specified in construction documents.	Shop (3) and field inspection	Y	Continuous	1	
7. Inspection of concrete and shotcrete placement for proper application techniques	Shop (3) and field inspection	N	Continuous		
8. Verify maintenance of specified curing temperature and techniques	Shop (3) and field inspection	Y	Periodic	1	
9. Inspection of prestressed concrete:	Shop (3) and field inspection				
a. Application of prestressing force		N	Continuous		
b. Grouting of bonded prestressing tendons		N	Continuous		
c. Verify proper installation of encapsulation caps and grouting of pocket recesses.		N	Periodic		
10. Erection of precast concrete members					
a. Inspect in accordance with construction documents	Field inspection	N	In accordance with construction documents		
b. Perform inspections of welding and bolting in accordance with Section 1705.2	Field inspection	N	In accordance with Section 1705.2		
c. Application of joint details at each connection	Field inspection	N	Periodic		
11. Verification of in-situ concrete strength, prior to stressing of tendons in post tensioned concrete and prior to removal of shores and forms from beams and structural slabs	Review field testing and laboratory reports	N	Periodic		
12. Inspection of formwork for shape, lines, location and dimensions	Field inspection	N	Periodic		
13. Testing of concrete floor flatness as required per construction documents.	Field testing	Y	Periodic	1	

(Schedule of Special Inspections Continued)					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
14. Concrete strength testing and verification of compliance with construction documents	Field testing and review of laboratory reports	Y	Periodic	1	
<b>1705.4 Masonry Construction</b>					
<b>MINIMUM VERIFICATION REQUIREMENTS</b>					
<b>(A) Level 1, 2, and 3 Quality Assurance:</b>					
1. Prior to construction, verification of compliance of submittals	Submittal Review	Y	Prior to Construction	1	
<b>(B) Level 2 and 3 Quality Assurance:</b>					
1. Prior to construction verification of f'm and f'AAC	Testing by unit strength method or prism test method	Y	Prior to Construction	1	
2. During construction, verification of Slump Flow and Visual Stability Index (VSI) when self-consolidating grout is delivered to project site.	Testing by unit strength method or prism test method	Y	Periodic	1	
<b>(C) Level 3 Quality Assurance:</b>					
1. During construction, verification of f'm and f'AAC for every 5,000 square feet	Testing by unit strength method or prism test method	N	Periodic		
2. During construction, verification of proportions of materials as delivered to the project site for premixed or preblended mortar, prestressing grout, and grout other than self-consolidating grout.	Field inspection	N	Periodic		
<b>MINIMUM SPECIAL INSPECTION REQUIREMENTS</b>					
<b>(D) Level 2 and 3 Quality Assurance:</b>					
1. As masonry construction begins, verify that the following are in compliance:					
a. Proportions of the site-prepared mortar	Field inspection	Y	Periodic	1	
b. Grade and size of prestressing tendons and anchorages	Field inspection	N	Periodic		
c. Grade, type, and size of reinforcement, anchor bolts, and prestressing tendons and anchorages	Field inspection	Y	Periodic	1	
d. Prestressing technique	Field inspection	N	Periodic		
e. Properties of thin-bed mortar for	Required for the first 5,000 square feet	Field inspection	N	Level 2 - Periodic	

(Schedule of Special Inspections Continued)						
MATERIAL / ACTIVITY		SERVICE	APPLICABLE TO THIS PROJECT			
			Y/N	EXTENT	AGENT*	DATE COMPLETED
AAC masonry	Required after the first 5,000 square feet		N	Level 3 - Continuous		
f. Sample panel construction		Field inspection	Y	Level 2 - Periodic	1	
			N	Level 3 - Continuous		
2. Prior to grouting, verify that the following are in compliance:						
a. Grout space		Field inspection	Y	Level 2 - Periodic	1	
			N	Level 3 - Continuous		
b. Placement of prestressing tendons and anchorages		Field inspection	N	Periodic		
c. Placement of reinforcement, connectors, and anchor bolts		Field inspection	Y	Level 2 - Periodic	1	
			N	Level 3 - Continuous		
d. Proportions of site-prepared grout and prestressing grout for bonded tendons		Field inspection	Y	Periodic	1	
3. Verify compliance of the following during construction:						
a. Materials and procedures with the approved submittals		Field inspection	Y	Periodic	1	
b. Placement of masonry units and mortar joint construction		Field inspection	Y	Periodic	1	
c. Size and location of structural members		Field inspection	Y	Periodic	1	
d. Type, size, location of anchors, including other details of anchorage of masonry to structural members, frames, or other construction		Field inspection	Y	Level 2 - Periodic	1	
			N	Level 3 - Continuous		
e. Welding of reinforcement		Field inspection	Y	Continuous	1	
f. Preparation, construction, and protection of masonry during cold weather (temperature below 40°F) or hot weather (temperature above 90°F)		Field inspection	Y	Periodic	1	
g. Application and measurement of prestressing force		Field inspection	N	Continuous		
h. Placement of grout and prestressing grout for bonded tendons is in compliance		Field inspection	N	Continuous		
i. Placement of AAC masonry units and construction of thin-bed mortar joints	Required for the first 5,000 square feet	Field inspection	N	Level 2 - Periodic		
	Required after the first 5,000 square feet		N	Level 3 - Continuous		

(Schedule of Special Inspections Continued)					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
4. Observe preparation of grout specimens, mortar specimens, and/or prisms	Field inspection	Y	Level 2 - Periodic	1	
		N	Level 3 - Continuous		
1705.5 Wood Construction					
1. For prefabricated wood structural elements, inspection of the fabrication process and assemblies in accordance with Section 1704.2.5.	In-plant review (3)	N	Periodic		
2. For high-load diaphragms, verify grade and thickness of structural panel sheathing agree with approved building plans	Field inspection	N	Periodic		
3. For high-load diaphragms, verify nominal size of framing members at adjoining panel edges, nail or staple diameter and length, number of fastener lines, and that spacing between fasteners in each line and at edge margins agree with approved building plans	Field inspection	N	Periodic		
4. Verify grade of lumber, manufactured wood products and sheathing.	Field inspection	N	Periodic		
5. Inspect details of wood framing including member types, sizes, spacing, blocking, bridging and bearing.	Field inspection	N	Periodic		
6. Inspect wood connections including nailing, bolting, tie downs, hangers and anchors.	Field inspection	N	Periodic		
7. Inspect diaphragms for sheathing thickness and for fastener size and spacing.	Field inspection	N	Periodic		
8. Metal-plate-connected wood trusses:					
a. Verification that permanent individual truss member restraint/bracing has been installed in accordance with the approved truss submittal package when the truss height is greater than or equal to 60".	Field inspection	N	Periodic		



(Schedule of Special Inspections Continued)					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
b. For trusses spanning 60 feet or greater: verify temporary and permanent restraint/bracing are installed in accordance with the approved truss submittal package	Field inspection	N	Periodic		
<b>1705.6 Soils</b>					
1. Verify materials below shallow foundations are adequate to achieve the design bearing capacity.	Field inspection	Y	Periodic	1	
2. Verify excavations are extended to proper depth and have reached proper material.	Field inspection	Y	Periodic	1	
3. Perform classification and testing of controlled fill materials.	Field inspection	Y	Periodic	1	
4. Verify use of proper materials, densities, and lift thicknesses during placement and compaction of controlled fill	Field inspection	Y	Continuous	1	
5. Prior to placement of controlled fill, observe subgrade and verify that site has been prepared properly	Field inspection	Y	Periodic	1	
<b>1705.7 Driven Deep Foundations</b>					
1. Verify element materials, sizes, and lengths comply with requirements	Field inspection	N	Continuous		
2. Determine capacities of test elements and conduct additional load tests, as required	Field inspection	N	Continuous		
3. Inspect driving operations and maintain complete and accurate records for each element	Field inspection	N	Continuous		
4. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and document any damage to foundation element	Field inspection	N	Continuous		
5. For steel elements, perform additional inspections per Section 1705.2	See Section 1705.2	N	See Section 1705.2		

(Schedule of Special Inspections Continued)					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
6. For concrete elements and concrete-filled elements, perform additional inspections per Section 1705.3	See Section 1705.3	N	See Section 1705.3		
7. For specialty elements, perform additional inspections as determined by the registered design professional in responsible charge	Field inspection	N	In accordance with construction documents		
8. Perform additional inspections and tests in accordance with the construction documents	Field Inspection and testing	N	In accordance with construction documents		
<b>1705.8 Cast-in-Place Deep Foundations</b>					
1. Inspect drilling operations and maintain complete and accurate records for each element	Field inspection	N	Continuous		
2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end-bearing strata capacity. Record concrete or grout volumes	Field inspection	N	Continuous		
3. For concrete elements, perform additional inspections in accordance with Section 1705.3	See Section 1705.3	N	See Section 1705.3		
4. Perform additional inspections and tests in accordance with the construction documents	Field Inspection and testing	N	In accordance with construction documents		
<b>1705.9 Helical Pile Foundations</b>					
1. Verify installation equipment, pile dimensions, tip elevations, final depth, final installation torque and other data as required.	Field inspection	N	Continuous		
2. Perform additional inspections and tests in accordance with the construction documents	Field Inspection and testing	N	In accordance with construction documents		
<b>1705.11.1 Structural Wood Special Inspections For Wind Resistance</b>					
1. Inspection of field gluing operations of elements of the main wind force-resisting system, including wood shear walls, wood diaphragms, drag struts, braces and hold-downs.	Field inspection	N	Continuous		

(Schedule of Special Inspections Continued)					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
2. Inspection of nailing, bolting, anchoring and other fastening of components within the main wind force-resisting system	Shop (3) and field inspection	N	Periodic		
<b>1705.11.2 Cold-formed Steel Special Inspections For Wind Resistance</b>					
1. Inspection during welding operations of elements of the main wind force-resisting system.	Shop (3) and field inspection	N	Periodic		
2. Inspections for screw attachment, bolting, anchoring and other fastening of components within the main windforce-resisting system, including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs.	Shop (3) and field inspection	N	Periodic		
<b>1705.11.3 Wind-resisting Components</b>					
1. Roof covering, roof deck and roof framing connections.	Shop (3) and field inspection	N	Periodic		
2. Exterior wall covering and wall connections to roof and floor diaphragms.	Shop (3) and field inspection	N	Periodic		
<b>1705.12.1 Structural Steel Special Inspections for Seismic Resistance</b>					
1. Seismic force-resisting systems in SDC B, C, D, E, or F.	Shop (3) and field inspection	N	In accordance with AISC 341		
2. Structural steel elements in SDC B, C, D, E, or F other than those in Item 1. including struts, collectors, chords and foundation elements.	Shop (3) and field inspection	N	In accordance with AISC 341		
<b>1705.12.2 Structural Wood Special Inspections for Seismic Resistance</b>					
1. Field gluing operations of elements of the seismic-force resisting system for SDC C, D, E or F.	Field inspection	N	Continuous		
2. Nailing, bolting, anchoring and other fastening of components within the seismic-force-resisting system including wood shear walls, wood diaphragms, drag struts, shear panels and hold-downs for SDC C, D, E or F.	Shop (3) and field inspection	N	Periodic		
<b>1705.12.3 Cold-formed Steel Light-Frame Construction Special Inspections for Seismic Resistance</b>					
1. During welding operations of elements of the seismic-force-resisting system for SDC C, D, E or F.	Shop (3) and field inspection	N	Periodic		

(Schedule of Special Inspections Continued)					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
2. Screw attachment, bolting, anchoring and other fastening of components within the seismic-force-resisting system including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs for SDC C, D, E or F.	Shop (3) and field inspection	N	Periodic		
<b>1705.12.4 Designated Seismic Systems Verification Designed Seismic Systems:</b>					
1. For SDC C, D, E or F, inspect and verify that the component label, anchorage or mounting conforms to the certificate of compliance in accordance with ASCE 7 Section 13.2.2.	Field inspection	Y	Periodic	1	
<b>1705.12.5 Architectural Components Special Inspections for Seismic Resistance</b>					
1. For SDC D, E or F, inspection during the erection and fastening of exterior cladding and interior or exterior veneer more than 30 feet above grade or walking surface and weighing more than 5 psf.	Field inspection	N	Periodic		
2. For SDC D, E or F, inspection during the erection and fastening of interior nonbearing walls more than 30 feet above grade or walking surface and weighing more than 15 psf.	Field inspection	N	Periodic		
3. For SDC D, E or F, inspection during the erection and fastening of exterior nonbearing walls more than 30 feet above grade or walking surface.	Field inspection	N	Periodic		
4. For SDC D, E or F, inspection during anchorage of access floors	Field inspection	N	Periodic		
<b>1705.12.6 Plumbing, Mechanical, and Electrical Components Special Inspections for Seismic Resistance</b>					
1. Inspection during the anchorage of electrical equipment for emergency or standby power systems in SDC C, D, E or F	Field inspection	Y	Periodic	1	
2. Inspection during the anchorage of other electrical equipment in SDC E or F	Field inspection	Y	Periodic	1	
3. Inspection during installation and anchorage of piping systems designed to carry hazardous materials, and their associated mechanical units in SDC C, D, E or F	Field inspection	Y	Periodic	1	
4. Inspection during the installation and anchorage of HVAC ductwork designed to contain hazardous materials in SDC C, D, E or F	Field inspection	Y	Periodic	1	

(Schedule of Special Inspections Continued)					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
5. Inspection during the installation and anchorage of vibration isolation systems in SDC C, D, E or F where nominal clearance of 1/4 inch or less is required by the approved construction documents	Field inspection	N	Periodic		
6. Inspection during installation of mechanical and electrical equipment, including duct work, piping systems and their structural supports, where automatic fire sprinkler systems are installed in structures assigned to SDC C, D, E, or F to verify one of the following unless flexible sprinkler hose fittings are used:					
a. ASCE 7, Section 13.2.3 minimum required clearances have been provided.	Field inspection	Y	Periodic	1	
b. A three inch or greater nominal clearance has been provided between fire protection sprinkler system drops and sprigs and: structural members not used collectively or independently to support the sprinklers; equipment attached to the building structure; and other systems' piping.	Field inspection	Y	Periodic	1	
<b>1705.12.7 Storage Racks Special Inspections for Seismic Resistance</b>					
1. Inspection during the anchorage of storage racks 8 feet or greater in height in structures assigned to SDC D, E or F.	Field inspection	N	Periodic		
<b>1705.12.8 Seismic Isolation Systems</b>					
1. Inspection during the fabrication and installation of isolator units and energy dissipation devices used as part of the seismic isolation system in structures assigned to SDC B, C, D, E or F.	Shop and field inspection	N	Periodic		
<b>1705.12.9 Cold-formed Steel Special Bolted Moment Frames</b>					
1. Inspection of installation of cold-formed steel special bolted moment frames in the seismic force-resisting systems in structures assigned to SDC D, E or F.	Field inspection	N	Periodic		
<b>1705.13.1 Structural Steel Testing for Seismic Resistance</b>					

(Schedule of Special Inspections Continued)					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
1. Nondestructive testing of structural steel in the seismic force-resisting systems in accordance with AISC 341 in structures assigned to SDC B, C, D, E or F.	Field test	N	Periodic		
2. Nondestructive testing of structural steel elements in the seismic force-resisting systems not covered in 1 above including struts, collectors, chords and foundation elements in accordance with AISC 341 in structures assigned to SDC B, C, D, E or F.	Field test	N	Periodic		
<b>1705.13.2 Seismic Certification of Nonstructural Components</b>					
1. Review certificate of compliance for designated seismic system components in structures assigned to SDC B, C, D, E or F.	Certificate of compliance review	Y	Each submittal	1	
<b>1705.13.3 Seismic Certification of Designated Seismic Systems</b>					
1. Review certificate of compliance for designated seismic system components in structures assigned to SDC C, D, E or F	Certificate of compliance review	Y	Each submittal	1	
<b>1705.13.4 Seismic Isolation Systems</b>					
1. Test seismic isolation system in accordance with ASCE 7 Section 17.8 in structures assigned to SDC B, C, D, E or F.	Prototype testing	N	Per ASCE 7		
<b>1705.14 Sprayed Fire-resistant Materials</b>					
1. Verify surface condition preparation of structural members	Field inspection	N	Periodic		
2. Verify minimum thickness of sprayed fire-resistant materials applied to structural members	Field inspection	N	Periodic		
3. Verify density of the sprayed fire-resistant material complies with approved fire-resistant design	Field inspection and testing	N	Per IBC Section 1705.14.5		
4. Verify the cohesive/adhesive bond strength of the cured sprayed fire-resistant material	Field inspection and testing	N	Per IBC Section 1705.14.6		
5. Condition of finished application	Field inspection	N	Periodic		
<b>1705.15 Mastic and Intumescent Fire-Resistant Coatings</b>					
1. Inspect and test mastic and intumescent fire-resistant coatings applied to structural elements and decks per AWCI 12-B	Field inspection and testing	N	Periodic		
<b>1705.16 Exterior Insulation and Finish Systems (EIFS)</b>					

(Schedule of Special Inspections Continued)					
MATERIAL / ACTIVITY	SERVICE	APPLICABLE TO THIS PROJECT			
		Y/N	EXTENT	AGENT*	DATE COMPLETED
2. Inspection of water-resistive barrier over sheathing substrate	Field inspection	N	Periodic		
<b>1705.17 Fire-Resistant Penetrations and Joints</b>					
1. Inspect penetration firestop systems	Field testing	N	Per ASTM E2174		
2. Inspect fire-resistant joint systems	Field testing	N	Per ASTM E2393		
<b>1705.18 Smoke Control Systems</b>					
1. Leakage testing and recording of device locations prior to concealment	Field testing	N	Periodic		
2. Prior to occupancy and after sufficient completion, pressure difference testing, flow measurements, and detection and control verification	Field testing	N	Periodic		
<b>* INSPECTION AGENTS</b>	<b>FIRM</b>	<b>ADDRESS</b>		<b>PHONE NO.</b>	
1. Qualified Testing Agent (TBD)					
2. Uzun + Case Engineers					
3.					
<b>NOTES:</b> 1. <i>The inspection and testing agent(s) shall be engaged by the Owner or the Owner's Agent and not by the Contractor or Subcontractor whose work is to be inspected or tested. Any conflict of interest must be disclosed to the Building Official prior to commencing work. The qualifications of the Special Inspector(s) and/or testing agencies may be subject to the approval of the Building Official and/or the Architect.</i> 2. <i>The list of Special Inspectors may be submitted as a separate document, if noted so above.</i> 3. <i>Shop Inspections of fabricated items are not required where the fabricator is approved in accordance with IBC Section 1704.2.5.1 and listed in activity 1709.2.</i> 4. <i>"Observe": Observe on a random basis, operations need not be delayed pending these inspections. "Perform": Perform these tasks for each welded joint, bolted connection, or steel element.</i> 5. <i>NDT of welds completed in an approved fabricator's shop may be performed by that fabricator's qualified Quality Control Inspector per when approved by the Building Official. Refer to AISC 360, N6.</i>					
Are Special Inspections for Seismic Resistance included in the Statement of Special Inspections?				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
Are Special Inspections for Wind Resistance included in the Statement of Special Inspections?				<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	

**CONTRACTOR'S STATEMENT OF RESPONSIBILITY**

Each contractor responsible for the construction or fabrication of a main wind or seismic force-resisting system, designated seismic system or wind or seismic-resisting component listed in the Statement of Special Inspections, Special Inspections for Seismic or Wind Resistance, must submit a Statement of Responsibility.

Project: Halcyon Village Building #1300

Contractor's Name: \_\_\_\_\_

Address: \_\_\_\_\_

License No.: \_\_\_\_\_

Description of building systems and components included in Statement of Responsibility:

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**Contractor's Acknowledgement of Special Requirements**

I hereby acknowledge that I have received, read, and understand the Statement of Special Inspections and Special Inspection program:

I hereby acknowledge that control will be exercised to obtain conformance with the approved construction documents.

\_\_\_\_\_  
Name and Title (type or print)

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date



**FABRICATORS CERTIFICATE OF COMPLIANCE**

Each approved fabricator that is exempt from Special Inspection of shop fabrication and implementation procedures per section 1704.2.5.1 of the International Building Code must submit *Fabricator's Certificate of Compliance* at the completion of fabrication.

Project: Halcyon Village Building #1300

Fabricator's Name: \_\_\_\_\_

Address: \_\_\_\_\_

Certification or Approval Agency: \_\_\_\_\_

Certification Number: \_\_\_\_\_

Date of Last Audit or Approval: \_\_\_\_\_

Description of structural members and assemblies that have been fabricated:

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I hereby certify that items described above were fabricated in strict accordance with the approved construction documents.

\_\_\_\_\_  
Name and Title (type or print)

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

Attach copies of fabricator's certification or building code evaluation service report and fabricator's quality control manual.

**FINAL REPORT OF SPECIAL INSPECTIONS****PROJECT:** Halcyon Village Building #1300**LOCATION:** \_\_\_\_\_**PERMIT APPLICANT:** \_\_\_\_\_**APPLICANT'S ADDRESS:** \_\_\_\_\_**ARCHITECT OF RECORD:** \_\_\_\_\_**STRUCTURAL ENGINEER OF RECORD:** James A. Jones, Uzun+Case, LLC**REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE:** \_\_\_\_\_

To the best of my information, knowledge, and belief, which are based upon observations or diligent supervision of our inspection services for the above-referenced Project, I hereby state that the special inspections or testing required for this Project, and designated for this Agent in the *Schedule of Special Inspection Services*, have been completed in accordance with the Contract Documents.

The Special Inspection program does not relieve the Contractor of the responsibility to comply with the Contract Documents. Jobsite safety and means and methods of construction are solely the responsibility of the Contractor.

Interim reports submitted prior to this final report and numbered \_\_\_ to \_\_\_ form a basis for and are to be considered an integral part of this final report. The following discrepancies that were outstanding since the last interim report dated \_\_\_\_\_ have been corrected:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

*(Attach 8 1/2"x11" continuation sheet(s) if required to complete the description of corrections)*

**Prepared By:**\_\_\_\_\_  
Special Inspection Agent/Firm\_\_\_\_\_  
Type or print name\_\_\_\_\_  
Signature\_\_\_\_\_  
Date

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## SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
  - 1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.
  - 2. Section 011200 "Multiple Contract Summary" for division of responsibilities for temporary facilities and controls.
  - 3. Section 017300 "Execution" for progress cleaning requirements.
  - 4. Section 313116 "Termite Control" for pest control.
  - 5. Divisions 02 through 49 Section for temporary heat, ventilation, and humidity requirements for products in those Sections.

## 1.3 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, testing agencies, and authorities having jurisdiction.
- B. Sewer Service: Pay sewer-service use charges for sewer usage by all entities for construction operations.
- C. Water Service: Pay water-service use charges for water used by all entities for construction operations.
- D. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.
- E. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

- F. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
- G. Sewer, Water, and Electric Power Service: Use charges are specified in Section 011200 "Multiple Contract Summary."

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Temporary Utility Reports: Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.
- C. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
  - 1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
  - 2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
  - 3. Indicate sequencing of Work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
- D. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
  - 1. Locations of dust-control partitions at each phase of work.
  - 2. HVAC system isolation schematic drawing.
  - 3. Location of proposed air-filtration system discharge.
  - 4. Waste handling procedures.
  - 5. Other dust-control measures.

#### 1.5 QUALITY ASSURANCE

- A. Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities" and NFPA 241.
  - 1. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

- C. Provisions and procedures shall comply with OSHA and other governmental requirements.
- D. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines **and ICC/ANSI A117.1**.

## 1.6 PROJECT CONDITIONS

- A. Temporary Utilities: At earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.
  - 1. Temporary use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.
- B. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:
  - 1. Keep temporary services and facilities clean and neat.
  - 2. Relocate temporary services and facilities as required by progress of the Work.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.
- B. Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top rails [with galvanized barbed-wire top strand].
- C. Portable Chain-Link Fencing: Minimum 2-inch (50-mm), 0.148-inch- (3.8-mm-) thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet (1.8 m) high with galvanized-steel pipe posts; minimum 2-3/8-inch- (60-mm-) OD line posts and 2-7/8-inch- (73-mm-) OD corner and pull posts, with 1-5/8-inch- (42-mm-) OD top and bottom rails. Provide galvanized-steel bases for supporting posts.
- D. Wood Enclosure Fence: Plywood, 6 feet (1.8 m) to 8 feet (2.4 m) high, framed with four 2-by-4-inch (50-by-100-mm) rails, with preservative-treated wood posts spaced not more than 8 feet (2.4 m) apart.
- E. Gypsum Board: Minimum 1/2-inch thick by 48 inches wide by maximum available lengths; regular-type panels with tapered edges. Comply with ASTM C 1396/C 1396M.

- F. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil (0.25-mm) minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.
- G. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches (914 by 1624 mm).
- H. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.
- I. Water: Potable.

## 2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:
  - 1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
  - 2. Conference room of sufficient size to accommodate meetings of a minimum of 10 individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot- (1.2-m-) square tack and marker boards.
  - 3. Drinking water and private toilet.
  - 4. Coffee machine and supplies.
  - 5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F (20 to 22 deg C).
  - 6. Lighting fixtures capable of maintaining average illumination of 20 fc (215 lx) at desk height.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
  - 1. Store combustible materials apart from building.

## 2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes of fire exposures.
  - 1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
  - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
  - 2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application for fuel source being consumed.
  - 3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of [8] at each return-air grille in system and remove at end of construction **and clean HVAC system as required in Section 017700 "Closeout Procedures"**.
- C. Self-Contained Toilet Units: Single-occupant units of chemical, aerated re-circulation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.
- D. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water, drinking-water units, including paper cup supply.
  - 1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 deg F (7.2 to 12.7 deg C).
- E. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.
- F. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V AC, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
  - 1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.



### 3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with match, compatible materials and equipment. Comply with utility company recommendations.
  - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
  - 2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
  - 3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.
- B. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged unlawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.
  - 1. Filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
  - 2. Connect temporary sewers to municipal system or private system indicated as directed by authorities having jurisdiction.
  - 3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. After heavy use, restore normal conditions promptly.
  - 4. Provide temporary filter beds, settlement tanks, separators, and similar devices to purify effluent to levels acceptable to authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction until permanent water service is in use. Sterilize temporary water piping before use.
- D. Water Service: Use of Owner's existing water service facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
  - 1. Provide rubber hoses as necessary to serve Project site.
  - 2. Where installations below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize water damage. Drain accumulated water promptly from pans.
- E. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
  - 1. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy.
  - 2. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used materials.

3. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel who handles materials that require wash up. Dispose of drainage properly. Supply cleaning compounds appropriate for each type of material handled.
  - a. Provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel.
4. Drinking-Water Facilities: Provide bottled-water, drinking-water units.
  - a. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 deg F (7.2 to 12.7 deg C).
- F. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed.
  1. Maintain a minimum temperature of 50 deg F (10 deg C) in permanently enclosed portions of building for normal construction activities, and 65 deg F (13.3 deg C) for finishing activities and areas where finished Work has been installed.
- G. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
  1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.
    - a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
    - b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
  2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
  3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.
- H. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
  1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

- I. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.
- J. Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations. Include meter, transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear.
  - 1. Install electric power service underground, unless overhead service must be used.
  - 2. Install power distribution wiring overhead and rise vertically where least exposed to damage.
  - 3. Connect temporary service to Owner's existing power source, as directed by Owner.
- K. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.
  - 1. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
- L. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
  - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
  - 2. Install lighting for Project identification sign.
  - 3. Provide one 100-W incandescent lamp per 500 sq. ft., uniformly distributed, for general lighting, or equivalent illumination.
  - 4. Provide one 100-W incandescent lamp every 50 feet in traffic areas.
  - 5. Provide one 100-W incandescent lamp per story in stairways and ladder runs, located to illuminate each landing and flight.
  - 6. Install exterior-yard site lighting that will provide adequate illumination for construction operations, traffic conditions, and signage visibility
- M. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install separate telephone line(s) for each field office and first-aid station.
  - 1. Provide additional telephone lines for the following:
    - a. Provide a dedicated telephone line for each facsimile machine in each field office.
    - b. In field office with more than two occupants, install a telephone for each additional occupant or pair of occupants.
  - 2. At each telephone, post a list of important telephone numbers.
    - a. Police and fire departments.

- b. Ambulance service.
  - c. Contractor's home office.
  - d. Contractor's emergency after-hours telephone number.
  - e. Architect's office.
  - f. Engineers' offices.
  - g. Owner's office.
  - h. Principal subcontractors' field and home offices.
- 3. Provide superintendent with cellular telephone for use when away from field office.
- 4. Provide an answering machine and voice-mail service on superintendent's telephone.
- N. Electronic Communication Service: Provide a computer in the primary field office adequate for access to Project electronic documents and maintain electronic communications. Equip computer with not less than the following:
  - 1. Network Connectivity: 10/100BaseT Ethernet.
  - 2. Printer: "All-in-one" unit equipped with printer server, combining color printing, photocopying, scanning, and faxing, or separate units for each of these three functions.
  - 3. Internet Service: Broadband modem, router and ISP, equipped with hardware firewall, at each computer.
  - 4. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.
  - 5. Backup: External hard drive, with automated backup software providing daily backups.

### 3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
  - 1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
  - 2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
  - 1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.

2. Prepare subgrade and install subbase and base for temporary roads and paved areas.
  3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
  4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course.
  5. Provide dust-control treatment that is non-polluting and non-tracking. Reapply treatment as required to minimize dust.
- C. Traffic Controls: Comply with requirements of authorities having jurisdiction.
1. Protect existing site improvements to remain including curbs, pavement, and utilities.
  2. Maintain access for fire-fighting equipment and access to fire hydrants.
- D. Parking: Provide temporary [Use designated areas of Owner's existing] parking areas for construction personnel.
- E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water. Comply with requirements in applicable Division 31 Sections for temporary drainage and dewatering facilities and operations not directly associated with construction activities included in individual Sections. Where feasible, use same facilities.
1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
  2. Remove snow and ice as required to minimize accumulations.
- F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
1. Identification Signs: Provide Project identification signs.
  2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
    - a. Provide temporary, directional signs for construction personnel and visitors.
  3. Maintain and touchup signs so they are legible at all times.
  4. Engage an experienced sign painter to apply graphics for Project identification signs.
- G. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution" and requirements in Section 017419 "Construction Waste Management and Disposal."
1. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste.

2. If required by authorities having jurisdiction, provide separate containers, clearly labeled, for each type of waste material to be deposited.
- H. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility services. Sheds may be open shelters or fully enclosed spaces within building or elsewhere on-site.
1. Construct framing, sheathing, and siding using fire-retardant-treated lumber and plywood.
- I. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- J. Temporary Elevator Use: See Section 142100 "Electric Traction Elevators," Section 142113 for temporary use of new elevators.
- K. Existing Elevator Use: Use of Owner's existing elevators will be permitted, as long as elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.
1. Do not load elevators beyond their rated weight capacity.
  2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.
- L. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.
- M. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.
- N. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.
1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If, despite such protection, stairs become damaged, restore damaged areas so no evidence remains of correction work.

### 3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.
  - 1. Comply with work restrictions specified in Section 011000 "Summary."
- C. Temporary Erosion and Sedimentation Control: Comply with **requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent and** requirements specified in Section 311000 "Site Clearing."
- D. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways.
  - 1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
  - 2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
  - 3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
  - 4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- E. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide earthen embankments and similar barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- F. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- G. Pest Control: Before deep foundation work has been completed, retain a local exterminator or pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion and final inspection prior to Final Completion. Obtain extended Warranty for Owner. Perform control operations lawfully, using environmentally safe materials.
- H. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations or as indicated in Drawings.
  2. Set fixed chain-link fence posts in compacted mixture of gravel and earth.
  3. Set portable chain-link fence posts in galvanized steel bases.
  4. Provide gates in sizes and at locations necessary to accommodate delivery vehicles and other construction operations.
  5. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Provide Owner with one set of keys.
- I. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.
- J. Barricades, Warning Signs, and Lights: Comply with standards and code requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard.
- K. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- L. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction **and requirements indicated on Drawings.**
1. Construct covered walkways using scaffold or shoring framing.
  2. Provide overhead decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
  3. Paint and maintain appearance of walkway for duration of the Work.
- M. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
  2. Vertical Openings: Close openings of 25 sq. ft. (2.3 sq. m) or less with plywood or similar materials.
  3. Horizontal Openings: Close openings in floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
  4. Install polyethylene sheets securely using fire-retardant-treated wood framing and other materials.
- N. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas from fumes and noise.



1. Construct dustproof partitions of not less than nominal 4-inch studs, 5/8-inch gypsum wallboard with joints taped on occupied side, and 1/2-inch fire-retardant-treated plywood on construction operations side.
  2. Construct dustproof partitions of not less than nominal 4-inch studs with two layers of 6-mil (0.14-mm) polyethylene sheet on each side. Cover floor with two layers of 6-mil (0.14-mm) polyethylene sheet, extending sheets 18 inches (460 mm) up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.
    - a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches (1219 mm) between doors. Maintain water-dampened foot mats in vestibule.
  3. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
  4. Insulate partitions to control noise transmission to occupied areas.
  5. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
  6. Protect air-handling equipment.
  7. Provide walk-off mats at each entrance through temporary partition.
  8. Weather-strip openings.
- O. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
1. Prohibit smoking in construction areas.
  2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
  3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
  4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.
  5. Provide fire extinguishers, installed on walls on mounting brackets, visible and accessible from space being served, with sign mounted above.
    - a. Locate fire extinguishers where convenient and effective for their intended purpose. Provide not less than one extinguisher on each floor at or near each usable stairwell.
  6. Store combustible materials in containers in fire-safe locations.
  7. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting. Prohibit smoking in hazardous fire-exposure areas.
  8. Permanent Fire Protection: At earliest feasible date in each area of Project, complete installation of permanent fire-protection facility, including connected

services, and place into operation and use. Instruct key personnel on use of facilities.

9. Provide hoses for fire-protection of sufficient length to reach construction areas. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and not to be removed. Match hose size with outlet size and equip with suitable nozzles.

### 3.5 MOISTURE AND MOLD CONTROL

- A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.
- B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
  1. Protect porous materials from water damage.
  2. Protect stored and installed material from flowing or standing water.
  3. Keep porous and organic materials from coming into prolonged contact with concrete.
  4. Remove standing water from decks.
  5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
  1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
  2. Keep interior spaces reasonably clean and protected from water damage.
  3. Periodically collect and remove waste containing cellulose or other organic matter.
  4. Discard or replace water-damaged material.
  5. Do not install material that is wet.
  6. Discard, replace, or clean stored or installed material that begins to grow mold.
  7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.
- D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
  1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
  2. Use permanent HVAC system to control humidity.
  3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
    - a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.

- b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
- c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

### 3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.
  - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
  - 2. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.
- D. Temporary Facility Changeover: Except for using permanent fire-protection, as soon as available, do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- E. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
  - 1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
  - 2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
  - 3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

## SECTION 016000 - PRODUCT REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
  - 1. Section 012100 "Allowances" for products selected under an allowance.
  - 2. Section 012300 "Alternates" for products selected under an alternate.
  - 3. Section 012500 "Substitution Procedures" for requests for substitutions.
  - 4. Section 013300 "Submittal Procedures" for procedural requirements for submitting product data and samples.
  - 5. Section 014200 "References" for applicable industry standards for products specified.
  - 6. Section 017700 "Closeout Procedures" for submitting warranties for Contract closeout.
  - 7. Divisions 02 through 49 Sections for specific requirements for warranties on products and installations specified to be warranted.

#### 1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
  - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
  - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
  - 3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance,

physical properties, appearance, and other characteristics that equal or exceed those of specified product.

- B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

#### 1.4 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
  - 2. Completed List: Within 60 day after date of commencement of Work, submit completed product list. Include a written explanation of omissions of data and for variations from Contract requirements.
  - 3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
    - a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
    - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

#### 1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
  - 1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
  - 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

## 1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
  - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
  - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
  - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
  - 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
  - 1. Store products to allow for inspection and measurement of quantity or counting of units.
  - 2. Store materials in a manner that will not endanger Project structure.
  - 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
  - 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
  - 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
  - 6. Protect stored products from damage and liquids from freezing.
  - 7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

## 1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
  - 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
  - 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

## PART 2 - PRODUCTS

### 2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products:
  - a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.

- b. Non-restricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
  - 4. Manufacturers:
    - a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered unless otherwise indicated.
    - b. Non-restricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
  - 5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
- C. Visual Matching Specification: Where Specifications require "match Architect's sample" or "match sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
  - 1. If no product available within specified category matches satisfactorily and complies with other specified requirements, comply with requirements in Section 012500 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements.
  - 1. Standard Range: Where Specifications include the phrase "as selected by Architect from manufacturer's standard range" or similar phrase, Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that does not include premium items.
  - 2. Full Range: Where Specifications include the phrase "as selected by Architect from manufacturer's standard range" or similar phrase, Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.



## 2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
  2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
  3. Evidence that proposed product provides specified warranty.
  4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
  5. Samples, if requested.

## PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

## SECTION 017300 - EXECUTION

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
  - 1. Construction layout.
  - 2. Field engineering and surveying.
  - 3. Installation of the Work.
  - 4. Coordination of Owner-installed products.
  - 5. Progress cleaning.
  - 6. Starting and adjusting.
  - 7. Protection of installed construction.
- B. Related Requirements:
  - 1. Section 011000 "Summary" for limits on use of Project site.
  - 2. Section 013300 "Submittal Procedures" for submitting surveys.
  - 3. Section 017329 "Cutting and Patching" for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work.
  - 4. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
  - 5. Section 024119 "Selective Demolition" for demolition and removal of selected portions of the building.
  - 6. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

## 1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For land surveyor.
- B. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.
- C. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

- D. Certified Surveys: Submit two copies signed by land surveyor.
- E. Final Property Survey: Submit 2 copies showing the Work performed and record survey data.

#### 1.4 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
- B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

### PART 2 - PRODUCTS (Not Used)

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Existing Conditions: The existence and location of site improvements, underground or other utilities, and other construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of utilities, mechanical and electrical systems, and other construction affecting the Work.
  - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
  - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
  - 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  - 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  - 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
  - 1. Description of the Work.
  - 2. List of detrimental conditions, including substrates.

3. List of unacceptable installation tolerances.
  4. Recommended corrections.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility and Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify Owner and/or others not less than two days in advance of proposed utility interruptions.
  2. Do not proceed with utility interruptions without Owner's written permission.
- C. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- D. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- E. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

### 3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
- B. General: Engage a land surveyor to lay out the Work using accepted surveying practices.
1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
  2. Establish limits on use of Project site.
  3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.

4. Inform installers of lines and levels to which they must comply.
  5. Check the location, level and plumb, of every major element as the Work progresses.
  6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
  7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

### 3.4 FIELD ENGINEERING

- A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
  2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
  2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
  3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- C. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

- D. Final Property Survey: Engage a land surveyor to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
  - 1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
  - 2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

### 3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  - 1. Make vertical work plumb and make horizontal work level.
  - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
  - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
  - 2. Allow for building movement, including thermal expansion and contraction.

3. Coordinate installation of anchorages. 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.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

### 3.6 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction personnel.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.
  1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
  2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

### 3.7 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one Installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
  1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
  3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
    - a. Use containers intended for holding waste materials of type to be stored.
  4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- B. Site: Maintain Project site free of waste materials and debris.

- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
  - 1. Remove liquid spills promptly.
  - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### 3.8 STARTING AND ADJUSTING

- A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."
- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.



- E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

### 3.9 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

### 3.10 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Section 017329 "Cutting and Patching."
  - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

## SECTION 017329 - CUTTING AND PATCHING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.
- B. Related Sections include the following:
  - 1. Section 024119 "Selective Structure Demolition" for demolition of selected portions of the building.
  - 2. Section 078413 "Penetration Firestopping" for patching fire-rated construction.
  - 3. Divisions 02 through 49 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

#### 1.3 DEFINITIONS

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

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Cutting and Patching Plan: Submit a proposal describing procedures at least 10 days prior to the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
  - 1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided along with the extent of refinishing required.
  - 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
  - 3. Products: List products to be used and firms or entities that will perform the Work.
  - 4. Dates: Indicate when cutting and patching will be performed.
  - 5. Utility Services and Mechanical/Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and

systems that will be relocated and those that will be temporarily out of service. Indicate how long services and systems will be disrupted.

- a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.
6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

## 1.5 QUALITY ASSURANCE

- A. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include the following:
  1. Primary operational systems and equipment.
  2. Air or smoke barriers.
  3. Fire-suppression systems.
  4. Mechanical systems piping and ducts.
  5. Control systems.
  6. Communication systems.
  7. Conveying systems.
  8. Electrical wiring systems.
  9. Operating systems of special construction in Division 13 Sections.
- C. Other Construction Elements: Do not cut and patch other construction elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Miscellaneous elements include the following:
  1. Water, moisture, or vapor barriers.
  2. Membranes and flashings.
  3. Exterior curtain-wall construction.
  4. Equipment supports.
  5. Piping, ductwork, vessels, and equipment.
  6. Noise- and vibration-control elements and systems.
- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in

a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

1. If possible, retain original Installer or Fabricator to cut and patch exposed Work. If it is not possible to engage original Installer or Fabricator, engage another recognized, experienced, and specialized firm.
- E. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

## 1.6 WARRANTY

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

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with sustainable design requirements.
- B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.

2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

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

### 3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
  1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
  1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
  5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  6. Proceed with patching after construction operations requiring cutting are complete.

- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
  2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
    - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    - b. Restore damaged pipe covering to its original condition.
  3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
  4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
  5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
  6. Fit work tight to pipes, sleeves, ducts, conduits, and penetrations through surfaces.
  7. Inspect existing conditions and completely fill gaps, openings, and any abandoned elements to provide a secure facility including potential for insect and rodent infestations.
- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

END OF SECTION 017329

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## SECTION 017700 - CLOSEOUT PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
  - 1. Substantial Completion procedures.
  - 2. Final completion procedures.
  - 3. Warranties.
  - 4. Final cleaning.
  - 5. Repair of the Work.
- B. Related Requirements:
  - 1. Section 012900 "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.
  - 2. Section 013233 "Photographic Documentation" for submitting final completion construction photographic documentation.
  - 3. Section 017300 "Execution" for progress cleaning of Project site.
  - 4. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
  - 5. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
  - 6. Section 017900 "Demonstration and Training" for requirements for instructing Owner's personnel.
  - 7. Divisions 02 through 49 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For cleaning agents.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.



#### 1.4 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest control inspection.

#### 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

#### 1.6 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
  - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
  - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  - 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Owner. Label with manufacturer's name and model number where applicable.
    - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section.
  - 5. Submit test/adjust/balance records.
  - 6. Submit sustainable design submittals not previously submitted.
  - 7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
1. Advise Owner of pending insurance changeover requirements.
  2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
  3. Complete startup and testing of systems and equipment.
  4. Perform preventive maintenance on equipment used prior to Substantial Completion.
  5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
  6. Advise Owner of changeover in heat and other utilities.
  7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
  8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
  9. Complete final cleaning requirements, including touchup painting.
  10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
  2. Results of completed inspection will form the basis of requirements for final completion.
  3. Contractor is responsible for any time allotted by Architect when project is not found to be of Substantial Completion.

## 1.7 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
  2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
  3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  4. Submit pest-control final inspection report.

5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
  1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

#### 1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction. Use CSI Form 14.1A.
  1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
  2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
  3. Include the following information at the top of each page:
    - a. Project name.
    - b. Date.
    - c. Name of Architect.
    - d. Name of Contractor.
    - e. Page number.
  4. Submit list of incomplete items in the following format:
    - a. PDF electronic file. Architect will return annotated file.

#### 1.9 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
  1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.

2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
  3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
  4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- C. Provide additional copies of each warranty to include in operation and maintenance manuals.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

## PART 3 - EXECUTION

### 3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
    - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.

- c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
  - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
  - e. Remove snow and ice to provide safe access to building.
  - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
  - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
  - h. Sweep concrete floors broom clean in unoccupied spaces.
  - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
  - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
  - k. Remove labels that are not permanent.
  - l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
  - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
  - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
  - o. Clean ducts, blowers, and coils if units were operated during construction or that display contamination with particulate matter on inspection.
    - 1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.
  - p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
  - q. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."

### 3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
  2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
    - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
  3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
  4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

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## SECTION 017823 - OPERATION AND MAINTENANCE DATA

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Operation and maintenance documentation directory.
  - 2. Emergency manuals.
  - 3. Operation manuals for systems, subsystems, and equipment.
  - 4. Product maintenance manuals.
  - 5. Systems and equipment maintenance manuals.
- B. Related Requirements:
  - 1. Section 011200 "Multiple Contract Summary" for coordinating operation and maintenance manuals covering the Work of multiple contracts.
  - 2. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
  - 3. Section 017700 "Closeout Procedures" for submitting operation and maintenance manuals.
  - 4. Section 017839 "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
  - 5. Section 019113 "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.
  - 6. Divisions 02 through 49 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

## 1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.



#### 1.4 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
  - 1. Architect **and Owner's representative** will comment on whether content of operations and maintenance submittals are acceptable.
  - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:
  - 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
    - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
    - b. Enable inserted reviewer comments on draft submittals.
  - 2. Two paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return one copy.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 15 days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Architect will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form at least 15 days prior to final inspection. Architect will return copy with comments.
  - 1. Correct or revise each manual to comply with Architect's comments. Submit three copies of each corrected manual within 15 days of receipt of Architect's comments.

### PART 2 - PRODUCTS

#### 2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
  - 1. List of documents.
  - 2. List of systems.
  - 3. List of equipment.

4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

## 2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
  1. Title page.
  2. Table of contents.
  3. Manual contents.
- B. Title Page: Include the following information:
  1. Subject matter included in manual.
  2. Name and address of Project.
  3. Name and address of Owner.
  4. Date of submittal.
  5. Name and contact information for Contractor.
  6. Name and contact information for Architect.
  7. Name and contact information for Commissioning Authority.
  8. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
  9. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
  1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
  - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
  - 2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
  - 1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
    - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
  - 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
  - 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
  - 4. Supplementary Text: Prepared on 8-1/2-by-11-inch (215-by-280-mm) white bond paper.
  - 5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
    - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

## 2.3 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
1. Type of emergency.
  2. Emergency instructions.
  3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
1. Fire.
  2. Flood.
  3. Gas leak.
  4. Water leak.
  5. Power failure.
  6. Water outage.
  7. System, subsystem, or equipment failure.
  8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
  2. Shutdown instructions for each type of emergency.
  3. Operating instructions for conditions outside normal operating limits.
  4. Required sequences for electric or electronic systems.
  5. Special operating instructions and procedures.

## 2.4 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
  2. Performance and design criteria if Contractor has delegated design responsibility.
  3. Operating standards.
  4. Operating procedures.
  5. Operating logs.
  6. Wiring diagrams.
  7. Control diagrams.
  8. Piped system diagrams.
  9. Precautions against improper use.
  10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

## 2.5 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
  - 1. Inspection procedures.
  - 2. Types of cleaning agents to be used and methods of cleaning.
  - 3. List of cleaning agents and methods of cleaning detrimental to product.
  - 4. Schedule for routine cleaning and maintenance.
  - 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
  - 1. Include procedures to follow and required notifications for warranty claims.

## 2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
  - 1. Standard maintenance instructions and bulletins.
  - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
  - 3. Identification and nomenclature of parts and components.
  - 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
  - 1. Test and inspection instructions.
  - 2. Troubleshooting guide.
  - 3. Precautions against improper maintenance.
  - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - 5. Aligning, adjusting, and checking instructions.

6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
  1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
  2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
  1. Include procedures to follow and required notifications for warranty claims.

## PART 3 - EXECUTION

### 3.1 MANUAL PREPARATION

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
- B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
  1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
  2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more

than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
1. Do not use original project record documents as part of operation and maintenance manuals.
  2. Comply with requirements of newly prepared record Drawings in Section 017839 "Project Record Documents."
- G. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823



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## SECTION 017839 - PROJECT RECORD DOCUMENTS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
  - 1. Record Drawings.
  - 2. Record Specifications.
  - 3. Record Product Data.
  - 4. Miscellaneous record submittals.
- B. Related Requirements:
  - 1. Section 011200 "Multiple Contract Summary" for coordinating project record documents covering the Work of multiple contracts.
  - 2. Section 017300 "Execution" for final property survey.
  - 3. Section 017700 "Closeout Procedures" for general closeout procedures.
  - 4. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
  - 5. Divisions 02 through 49 Sections for specific requirements for Project Record Documents of the Work in those Sections.

## 1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
  - 1. Number of Copies: Submit copies of record Drawings as follows:
    - a. Initial Submittal:
      - 1) Submit PDF electronic files of scanned Record Prints and one of file prints.
      - 2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
    - b. Final Submittal:

- 1) Submit PDF electronic files of scanned Record Prints and two set(s) of prints.
  - 2) Print each drawing, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

## PART 2 - PRODUCTS

### 2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up Record Prints.
    - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    - b. Accurately record information in an acceptable drawing technique.
    - c. Record data as soon as possible after obtaining it.
    - d. Record and check the markup before enclosing concealed installations.
    - e. Cross-reference record prints to corresponding archive photographic documentation.
  2. Content: Types of items requiring marking include, but are not limited to, the following:
    - a. Dimensional changes to Drawings.
    - b. Revisions to details shown on Drawings.
    - c. Depths of foundations below first floor.
    - d. Locations and depths of underground utilities.
    - e. Revisions to routing of piping and conduits.
    - f. Revisions to electrical circuitry.
    - g. Actual equipment locations.

- h. Duct size and routing.
    - i. Locations of concealed internal utilities.
    - j. Changes made by Change Order or Construction Change Directive.
    - k. Changes made following Architect's written orders.
    - l. Details not on the original Contract Drawings.
    - m. Field records for variable and concealed conditions.
    - n. Record information on the Work that is shown only schematically.
  - 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up Record Prints.
  - 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
  - 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
  - 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up Record Prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings and Shop Drawings, as follows:
- 1. Format: Annotated PDF electronic file.
  - 2. Incorporate changes and additional information previously marked on Record Prints. Delete, redraw, and add details and notations where applicable.
  - 3. Refer instances of uncertainty to Architect for resolution.
    - a. See Section 013300 "Submittal Procedures" for requirements related to use of Architect's digital data files.
- C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
- 1. Record Prints: Organize Record Prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
  - 2. Format: Annotated PDF electronic file.
  - 3. Identification: As follows:
    - a. Project name.
    - b. Date.
    - c. Designation "PROJECT RECORD DRAWINGS."
    - d. Name of Architect.
    - e. Name of Contractor.

## 2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
  - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  - 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
  - 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
  - 4. Note related Change Orders, record Product Data, and Record Drawings where applicable.
- B. Format: Submit record Specifications as annotated PDF electronic file.

## 2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
  - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  - 3. Note related Change Orders, record Specifications, and record Drawings where applicable.
- B. Format: Submit record Product Data as annotated PDF electronic file.
  - 1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

## 2.4 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as PDF electronic file.
  - 1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

## PART 3 - EXECUTION

### 3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and revisions to Project Record Documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION 017839

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## SECTION 017900 - DEMONSTRATION AND TRAINING

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
  - 1. Demonstration of operation of systems, subsystems, and equipment.
  - 2. Training in operation and maintenance of systems, subsystems, and equipment.
  - 3. Demonstration and training video recordings.

## 1.3 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
  - 1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
- B. Attendance Record: For each training module, submit list of participants and length of instruction time.
- C. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

## 1.4 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
  - 1. Identification: On each copy, provide an applied label with the following information:
    - a. Name of Project.
    - b. Name and address of videographer.



- c. Name of Architect.
  - d. Name of Contractor.
  - e. Date of video recording.
- 2. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
  - 3. At completion of training, submit complete training manual(s) for Owner's use in PDF electronic file format on compact disc.

## 1.5 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.
- D. Preinstruction Conference: Conduct conference at Project site. Review methods and procedures related to demonstration and training including, but not limited to, the following:
  - 1. Inspect and discuss locations and other facilities required for instruction.
  - 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
  - 3. Review required content of instruction.
  - 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

## 1.6 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Architect.

## PART 2 - PRODUCTS

### 2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
  - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
    - a. System, subsystem, and equipment descriptions.
    - b. Performance and design criteria if Contractor is delegated design responsibility.
    - c. Operating standards.
    - d. Regulatory requirements.
    - e. Equipment function.
    - f. Operating characteristics.
    - g. Limiting conditions.
    - h. Performance curves.
  - 2. Documentation: Review the following items in detail:
    - a. Emergency manuals.
    - b. Operations manuals.
    - c. Maintenance manuals.
    - d. Project record documents.
    - e. Identification systems.
    - f. Warranties and bonds.
    - g. Maintenance service agreements and similar continuing commitments.
  - 3. Emergencies: Include the following, as applicable:
    - a. Instructions on meaning of warnings, trouble indications, and error messages.
    - b. Instructions on stopping.
    - c. Shutdown instructions for each type of emergency.
    - d. Operating instructions for conditions outside of normal operating limits.
    - e. Sequences for electric or electronic systems.
    - f. Special operating instructions and procedures.
  - 4. Operations: Include the following, as applicable:
    - a. Startup procedures.
    - b. Equipment or system break-in procedures.

- c. Routine and normal operating instructions.
  - d. Regulation and control procedures.
  - e. Control sequences.
  - f. Safety procedures.
  - g. Instructions on stopping.
  - h. Normal shutdown instructions.
  - i. Operating procedures for emergencies.
  - j. Operating procedures for system, subsystem, or equipment failure.
  - k. Seasonal and weekend operating instructions.
  - l. Required sequences for electric or electronic systems.
  - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
- a. Alignments.
  - b. Checking adjustments.
  - c. Noise and vibration adjustments.
  - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
- a. Diagnostic instructions.
  - b. Test and inspection procedures.
7. Maintenance: Include the following:
- a. Inspection procedures.
  - b. Types of cleaning agents to be used and methods of cleaning.
  - c. List of cleaning agents and methods of cleaning detrimental to product.
  - d. Procedures for routine cleaning
  - e. Procedures for preventive maintenance.
  - f. Procedures for routine maintenance.
  - g. Instruction on use of special tools.
8. Repairs: Include the following:
- a. Diagnosis instructions.
  - b. Repair instructions.
  - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - d. Instructions for identifying parts and components.
  - e. Review of spare parts needed for operation and maintenance.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

### 3.2 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
  - 1. Owner will furnish an instructor to describe Owner's operational philosophy.
  - 2. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
  - 1. Schedule training with Owner with at least seven days' advance notice.
- D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.
- E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

### 3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
  - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Video: Provide minimum 640 x 480 video resolution converted to format file type acceptable to Owner, on electronic media.
  - 1. Electronic Media: Read-only format compact disc acceptable to Owner, with commercial-grade graphic label.

2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.
  3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.
  4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:
    - a. Name of Contractor/Installer.
    - b. Business address.
    - c. Business phone number.
    - d. Point of contact.
    - e. E-mail address.
- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
1. Film training session(s) in segments not to exceed 15 minutes.
    - a. Produce segments to present a single significant piece of equipment per segment.
    - b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
    - c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.
- D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
1. Furnish additional portable lighting as required.
- E. Narration: Describe scenes on video recording by dubbing audio narration off-site after video recording is recorded. Include description of items being viewed.
- F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.
- G. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION 017900

## SECTION 03 35 43 POLISHED CONCRETE FINISH

## PART 1 GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Polished concrete finish in accordance with specified requirements to produce:
    - a. Aggregate Exposure A
    - b. Concrete Appearance 2
- B. Related Sections:
  - 1. 03 30 00 Cast In Place Concrete

## 1.2 REFERENCES

- A. American National Standards Institute ([www.ansi.org](http://www.ansi.org))
  - 1. B101.3 -Test Method for Measuring Wet DCOF of Common Hard Surface Floor Materials.
- B. ASTM International ([www.astm.org](http://www.astm.org))
  - 1. D4039 – Standard Test method for Reflection Haze of High-Gloss Surfaces
  - 2. D523 – Standard Test Method for Specular Gloss
  - 3. D5767 – Standard Test method for Instrumental Measurement of Distinctness-of-Image (DOI) Glass of Coated Surfaces
- C. Terminology: Concrete Polishing Council's glossary ([www.ascconline.org](http://www.ascconline.org))
  - 1. Definitions.
  - 2. Aggregate Exposure Chart.
  - 3. Concrete Appearance Chart.

## 1.3 SUBMITTALS

- A. Submittals for Review:
  - 1. Product Data: Manufacturer's descriptive data for the following:
    - a. Cleaner
    - b. Densifier
    - c. Protector
    - d. Maintenance Instructions
- B. Quality Control Submittals:
  - 1. Manufacturers approval of applicator certificate.
  - 2. Pre-concrete finishing conference meeting notes.
  - 3. Post-installation testing results:
    - a. ASTM D5767 Distinctness-of-Image, percentage
    - b. ASTM D523 – Standard Test Method for Specular Gloss
- C. Sustainable Design Submittals:
  - 1. Low-Emitting per California Department Public Health Standard Method, Section 01350

## 1.4 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Minimum 5 years documented experience in work of this Section.
  - 2. Accepted by Manufacturer.
- B. Manufacturer:
  - 1. Minimum 5 years documented experience in producing concrete materials.
  - 2. Materials meet third party compliance with Low-Emitting per California Department Public Health Standard Method, Section 01350.
- C. Pre-Concrete Finishing Conference
  - 1. Schedule: Two (2) weeks prior to pouring cast-in-place concrete
  - 2. Attendance: Concrete installer, Polishing installer, Owner's Representative
  - 3. Record the proceeding in the form of minutes of meeting.
  - 4. Review and discuss:
    - a. Floor flatness (FF and FL) requirements
      - 1.  $F_F$  45/  $F_L$  35 – very flat
      - 2.  $F_F$  60/  $F_L$  40 – super flat
    - b. Selected aggregate exposure and appearance requirements.
- E. Mock- Up Approval Conference
  - 1. Schedule: Four (4) weeks prior to installation
  - 2. Size: 100 square feet
  - 3. Location: Area subjected to direct and indirect sunlight
  - 4. Attendance: Owner, Architect, Polishing installer
  - 5. Review and discuss installed mock-up and the following for approval:
    - a. Interior environmental requirements.
    - b. Review submittal samples.
    - c. Review aggregate exposure and appearance requirements.
    - d. ASTM D5767 Distinctness-of-Image requirements
    - e. ASTM D4039 Reflection Haze of High-Gloss Surfaces requirements
    - f. Staging and sequencing.
    - g. Protection of completed work.
  - 6. Mockup may remain as part of the Work when approved by Architect.

## 1.5 PROJECT CONDITIONS

- A. Prohibit concrete surfaces from the following prior to and after application process:
  - 1. Vehicular traffic and pipe cutting operations in, around and above surfaces
  - 2. Storage of wood, ferrous metals, plastic, or any other materials to prevent damage
  - 3. Liquid drippings, sprinkler discharge and sprinkler testing on surfaces.
  - 4. Chemical storage, acids and acidic detergents
  - 5. Prevent painting over surfaces without 100% floor protection from overspray.
  - 6. Diaper all hydraulic lines of equipment that must enter polished floor spaces.
- B. Maintain interior room conditions of 50 and 90 degrees F.
- C. Ventilate areas to promote proper curing of components.
- D. Restrict trade traffic from work areas during and after application process.

## 1.6 MAINTENANCE

A. Deliver 1-gallon of cleaner and maintenance instructions to Owner at substantial completion.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
1. Lythic by Solomon Colors ([www.lythic.com](http://www.lythic.com))
  2. MirrorCrete ([www.floorseal.com](http://www.floorseal.com))
  3. SpecTru Systems

B. Substitutions: Under provisions of Division 01

### 2.2 MATERIALS

- A. Surface Cleaner: Water-based, colloidal silica blended surfactant, silica dust reducer
1. Source: Lythic Cleaner by Solomon Colors.
  2. VOC Content: CPDH, LEED v4 Compliant
  3. pH Level: 10.5pH, non-hazardous waste per EPA requirements.
- B. Hardener and Densifier: Water-based, colloidal silica, odorless, penetrating hardener
1. Source: Lythic Densifier & XL by Lythic
  2. VOC Content: 0 grams per liter
  3. pH level: 10.5pH or less, non-hazardous waste per EPA requirements.
- C. Protector: Water-based, penetrating film forming protector, colloidal-silica co-polymer acrylic
1. Source: Protector by Lythic
  2. VOC Content: CPDH, LEED v4 Compliant
  3. pH level: 10.5pH or less, non-hazardous waste per EPA requirements.

### 2.3 ACCESSORIES

- A. Crack and Joint Treatment: Polyurea-based joint filler by one of the following:
1. Metzger McGuire [www.metzgermcguire.com](http://www.metzgermcguire.com)
  2. SealBoss [www.sealboss.com](http://www.sealboss.com)
  3. VersaFlex [www.versaflex.com](http://www.versaflex.com)
- B. Spall, Surface Defect and Resin Grout Material: Epoxy- Polyurea-based material by one of the following:
1. Quick Mender by VersaFlex [www.versaflex.com](http://www.versaflex.com)
  2. TX3 by Hi-Tech Systems [www.hitechpolyurea.com](http://www.hitechpolyurea.com)
  3. Match Patch Pro [www.matchpatchpro.com](http://www.matchpatchpro.com)
- C. Cementitious Grout: Unsanded, fast curing, hydraulic cement-based floor material by one of the following:
1. CTS RapidSet Skim Coat [www.ctscements.com](http://www.ctscements.com)



- D. Temporary Protection: Seamless, spill, stain and water-resistant sheeting.
1. Ramboard [www.ramboard.com](http://www.ramboard.com)
  2. Skudo Commercial Mat System [www.skudousa.com](http://www.skudousa.com)

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine substrate with installer present for conditions affecting work performance of finish.
- B. Installation deems acceptance of on site conditions.

### 3.2 PREPARATION

- A. Clean concrete surface of contaminants and repair imperfections to match adjacent surfaces.
- B. Protect equipment and previously installed finished from process.
- C. Verify mock-up has been approved prior to starting work.

### 3.3 APPLICATION

- A. Provide gloss and aggregate exposure requirements in accordance to Concrete Polishing Council terminology.
- B. Apply spall, surface defect, crack and joint treatment and grout material to achieve a uniform surface appearance.
- C. Perform required process to achieve approved aggregate exposure and appearance in accordance with the following: [\(see next page\)](#)

#### 3.3 / D. / 1. Aggregate Exposure Chart

Aggregate Exposure Chart		
Class	Name	Surface Exposure, %
A	Cream Fines	85 – 95% Cement Fines
		5 – 15% Fine Aggregates

B	Fine Aggregate	85 – 95% Fine Aggregates 5 – 15% Blend of Cement Fines and Coarse Aggregates
C	Coarse Aggregate	80 - 90% Coarse Aggregate 10 - 20% Blend of Cement Fines and Fine Aggregates

Aggregate exposure class denotes the surface exposure after grinding and polishing operations. The density, size and distribution of the aggregates at the surface depends on the concrete mix design and placing and finishing operations. Floor flatness at the time of grinding and polishing operations is an important consideration in selecting the appropriate aggregate exposure class. Surface exposure percentages are based on visual observation of the overall area of the polished floor.

## 3.3 / D. / 2. Appearance Chart

Appearance Chart				
Level	Name	Reflective Clarity	Image Clarity Value, % ASTM D5767, D4039	Haze Index ASTM D4039
1	Flat (Ground)	Images of objects being reflected have a flat appearance.	0 - 9	< 10
2	Satin (Honed)	Images of objects being reflected have a matte appearance.	10 - 39	
3	Polished	Images of objects being reflected do not have a sharp and crisp appearance but can easily identified.	40 - 69	
4	Highly Polished	Images of objects being reflected have a sharp and crisp as appearance as would be seen in a near-mirror like reflection. May require grouting.	70 - 100	

## D. Protector:

1. Apply in accordance with manufacturers instructions.
2. Burnish to produce maximum appearance and protection properties.

## 3.4 FIELD QUALITY CONTROL

- A. Measure slip resistance in accordance with ANSI B101.3 -Test Method for Measuring Wet Dynamic Coefficient of Friction (DCOF) of Common Hard Surface Floor Materials.

1. Results of [high traction] [0.50] [dry] [wet] in accordance with Americans with Disabilities Act (ADA) and Occupational Safety and Health Administration (OSHA).
- B. Final Floor Testing:
1. Perform five (5) of the following surface tests at various locations:
    - a. ASTM D5767 Distinctness-of-Image
    - b. ASTM D523 – Standard Test Method for Specular Gloss
  2. Do not proceed with sealer and water repellant application until floors pass testing.
  3. Final floors to be smooth with no scratches in polish finish during inspection prior to sealer and water
- C. Allow floors to cure for 24 hours and install protective coverings to prevent contamination, stains and damage.
- 3.5 PROTECTION
- A. Allow floors to dry and cover with manufacturer approved non-staining, temporary protection.

END OF SECTION

## SECTION 036200 - NON-SHRINK GROUT

## PART 1 - GENERAL

## 1.1 SECTION INCLUDES

- A. Section includes non-shrink grout under base plates, bearing plates, and where specified in Contract Documents.

## 1.2 RELATED SECTIONS

- A. Section 013330 – Structural Submittals
- B. Section 014525 - Structural Testing/Inspection Agency Services.

## 1.3 REFERENCES

- A. ASTM C1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
- B. ASTM C109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens).

## 1.4 QUALITY ASSURANCE

- A. Structural Testing/Inspection Agency shall perform the following quality related items:
  - 1. Perform compressive strength tests in accordance with ASTM C109 with 2-inch x 2-inch cubes. Test one cube at three days, two cubes at seven days and three cubes at 28 days. Perform one test for each ten bags of grout used or one test in accordance with day of grouting.

## 1.5 SUBMITTALS

- A. Submit product data sheets for review.

## PART 2 - PRODUCTS

## 2.1 GROUT

- A. Provide a non-shrink, non-metallic grout that complies with ASTM C1107.
- B. Grout shall have a minimum compressive strength of 5000 psi at 28 days.

## 2.2 WATER

- A. Provide clean, potable water.

## PART 3 - EXECUTION

### 3.1 HANDLING

- A. Store and protect non-shrink grout from moisture and contamination.

### 3.2 PREPARATION

- A. Remove mud, dirt and other foreign materials from areas to be grouted.

### 3.3 MIXING

- A. Mix grout to its fluid, self-leveling consistency in accordance with manufacturers recommendations. Do not retemper grout. Do not exceed manufacturer's maximum limit on water content or use at a consistency which produces free bleeding. Mix grout in a paddle-type mortar mixer. Do not mix by hand.

### 3.4 PLACEMENT

- A. Consolidate grout to provide uniformity. Do not vibrate grout.
- B. Use forms to contain grout.

### 3.5 PROTECTION

- A. Protect grout and areas to be grouted from excessive heat and cold in accordance with manufacturer's specifications. Protect grout from excessive drying shrinkage resulting from wind or direct sunlight. Protect areas grouted from excessive vibrations for three days.

END OF SECTION 036200

## SECTION 042000 - UNIT MASONRY

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

## A. Section Includes:

1. Concrete masonry units.
2. Clay face brick.
3. Mortar and grout.
4. Steel reinforcing bars.
5. Masonry-joint reinforcement.
6. Ties and anchors.
7. Embedded flashing.
8. Miscellaneous masonry accessories.
9. Masonry-cell fill.

## B. Products Installed but not Furnished under This Section:

1. Steel lintels in unit masonry.
2. Steel shelf angles for supporting unit masonry.
3. Cavity wall insulation.

## C. Related Requirements:

1. Section 051200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
2. Section 076200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

## 1.3 DEFINITIONS

- A. CMU(s): Concrete masonry unit(s).
- B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

## 1.4 PRE-INSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct conference at Project site.

## 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For the following:
  - 1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
  - 2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.
  - 3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.
- C. Samples for Verification: For each type and color of the following:
  - 1. Clay face, in the form of straps of five or more bricks.
  - 2. Special brick shapes.
  - 3. Weep holes and cavity vents.
  - 4. Accessories embedded in masonry.

## 1.6 INFORMATIONAL SUBMITTALS

- A. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
  - 1. Submittal is for information only. Receipt of list does not constitute approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.
- B. Qualification Data: For testing agency.
- C. Material Certificates: For each type and size of the following:
  - 1. Masonry units.
    - a. Include data on material properties.
    - b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
    - c. For exposed brick, include test report for efflorescence according to ASTM C 67.
    - d. For surface-coated brick, include test report for durability of surface appearance after 50 cycles of freezing and thawing according to ASTM C 67.
  - 2. Integral water repellent used in CMUs.
  - 3. Cementitious materials. Include name of manufacturer, brand name, and type.
  - 4. Mortar admixtures.
  - 5. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.

6. Grout mixes. Include description of type and proportions of ingredients.
  7. Reinforcing bars.
  8. Joint reinforcement.
  9. Anchors, ties, and metal accessories.
- D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.
1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.
  2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.
- E. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

## 1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.
- B. Sample Panels: Build sample panels to verify selections made under Sample submittals and to demonstrate aesthetic effects. Comply with requirements in Section 014000 "Quality Requirements" for mockups.
1. Build sample panels for each type of exposed unit masonry construction in sizes approximately 60 inches (1500 mm) long by 48 inches (1200 mm) high by full thickness.
  2. Build sample panels facing south.
  3. Clean exposed faces of panels with masonry cleaner indicated.
  4. Protect approved sample panels from the elements with weather-resistant membrane.
  5. Approval of sample panels is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Architect in writing.
    - a. Approval of sample panels does not constitute approval of deviations from the Contract Documents contained in sample panels unless Architect specifically approves such deviations in writing.
- C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
1. Build mockups for typical exterior wall in sizes approximately 96 inches (2400 mm) long by 72 inches (1800 mm) high by full thickness, including face and backup wythes and accessories.



- a. Include a sealant-filled joint at least 16 inches (400 mm) long in exterior wall mockup.
  - b. Include lower corner of window opening in exterior wall mockup. Make opening approximately 24 inches (600 mm) wide by 24 inches (600 mm) high.
  - c. Include through-wall flashing installed for exterior wall mockup with a 12-inch (300-mm) length of flashing left exposed to view (omit masonry above half of flashing).
  - d. Include metal studs, sheathing, water-resistive barrier or air barrier, sheathing joint-and-penetration treatment, veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.
2. Clean exposed faces of mockups with masonry cleaner as indicated.
  3. Protect accepted mockups from the elements with weather-resistant membrane.
  4. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.
    - a. Approval of mockups is also for other material and construction qualities specifically approved by Architect in writing.
    - b. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

## 1.9 FIELD CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches (600 mm) down both sides of walls, and hold cover securely in place.
  2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe, and hold cover in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.
- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
  2. Protect sills, ledges, and projections from mortar droppings.
  3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
  4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.
1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

## 2.2 UNIT MASONRY, GENERAL

- A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6, except as modified by requirements in the Contract Documents.
- B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.
- C. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
  - 1. Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

## 2.3 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
  - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
  - 2. Provide square-edged units for outside corners unless otherwise indicated.
- B. Integral Water Repellent: Provide units made with integral water repellent.
  - 1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514/E 514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.
    - a. Products: Subject to compliance with requirements, provide one of the following:
      - 1) ACM Chemistries; RainBloc.
      - 2) BASF Corporation; Construction Systems; MasterPel 240 or MasterPel 200HD.
      - 3) Euclid Chemical Company (The); an RPM company; Eucon Blocktite.
      - 4) GCP Applied Technologies Inc. (formerly Grace Construction Products); Dry-Block.
- C. CMUs: ASTM C 90.
  - 1. Density Classification: Normal weight, unless otherwise indicated.
  - 2. Size (Width): Manufactured to dimensions 3/8 inch (10 mm) less than nominal dimensions.
  - 3. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

4. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.

## 2.4 CONCRETE AND MASONRY LINTELS

- A. General: Provide one of the following:
- B. Concrete Lintels: ASTM C 1623, matching CMUs in color, texture, and density classification; and with reinforcing bars indicated.
- C. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Section 033000 "Cast-in-Place Concrete," and with reinforcing bars indicated.
- D. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

## 2.5 BRICK

- A. General: Provide shapes indicated in drawings and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:
  1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
  2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
  3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
  4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

## 2.6 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150/C 150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
  1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Masonry Cement: ASTM C 91/C 91M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Cemex S.A.B. de C.V.
  - b. Holcim (US) Inc.
  - c. Lafarge North America Inc.
  - d. Lehigh Hanson; HeidelbergCement Group.

E. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979/C 979M. Use only pigments with a record of satisfactory performance in masonry mortar.

F. Colored Cement Products: Packaged blend made from portland cement and hydrated lime or masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Colored Portland Cement-Lime Mix:

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1) Holcim (US) Inc.
  - 2) Lafarge North America Inc.
  - 3) Lehigh Hanson; HeidelbergCement Group.

2. Colored Masonry Cement:

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1) Cemex S.A.B. de C.V.
  - 2) Holcim (US) Inc.
  - 3) Lafarge North America Inc.
  - 4) Lehigh Hanson; HeidelbergCement Group.
3. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
4. Pigments shall not exceed 10 percent of portland cement by weight.
5. Pigments shall not exceed 5 percent of masonry cement by weight.

G. Aggregate for Mortar: ASTM C 144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch (6 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

- H. Aggregate for Grout: ASTM C 404.
- I. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. ACM Chemistries; RainBloc for Mortar.
    - b. BASF Corporation; Construction Systems; MasterPel 240MA or MasterPel 210D.
    - c. Euclid Chemical Company (The); an RPM company; BLOCKTITE MORTAR ADMIXTURE.
    - d. GCP Applied Technologies Inc. (formerly Grace Construction Products); Dry-Block Mortar Admixture.
- J. Water: Potable.

## 2.7 REINFORCEMENT

- A. Uncoated-Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60 (Grade 420).
- B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch (3.77-mm) steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Dur-O-Wal; a Hohmann & Barnard company; D/A 810, D/A 812 or D/A 817.
    - b. Heckmann Building Products, Inc.; No. 376 Rebar Positioner.
    - c. Hohmann & Barnard, Inc; #RB or #RB-Twin Rebar Positioner.
    - d. Wire-Bond; Core Lock Rebar Positioner.
- C. Masonry-Joint Reinforcement, General: ASTM A 951/A 951M.
  - 1. Interior Walls: Hot-dip galvanized carbon steel.
  - 2. Exterior Walls: Hot-dip galvanized carbon steel.
  - 3. Wire Size for Side Rods: 0.187-inch (4.76-mm) diameter.
  - 4. Wire Size for Cross Rods: 0.187-inch (4.76-mm) diameter.
  - 5. Wire Size for Veneer Ties: 0.187-inch (4.76-mm) diameter.
  - 6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches (407 mm) o.c.
  - 7. Provide in lengths of not less than 10 feet (3 m), with prefabricated corner and tee units.
- D. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder type with single pair of side rods.
- E. Masonry-Joint Reinforcement for Multiwythe Masonry:

1. Adjustable (two-piece) type, either ladder or truss design, with one side rod at each face shell of backing wythe and with separate adjustable ties with pintle-and-eye connections having a maximum horizontal play of 1/16 inch (1.5 mm) and maximum vertical adjustment of 1-1/4 inches (32 mm). Size ties to extend at least halfway through facing wythe but with at least 5/8-inch (16-mm) cover on outside face.

## 2.8 TIES AND ANCHORS

- A. General: Ties and anchors shall extend at least 1-1/2 inches (38 mm) into veneer but with at least a 5/8-inch (16-mm) cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
  1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.
- C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
  1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- (6.35-mm-) diameter, hot-dip galvanized steel wire.
  2. Tie Section: Triangular-shaped wire tie made from 0.187-inch- (4.76-mm-) diameter, hot-dip galvanized steel wire.
- D. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
  1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.062-inch- (1.59-mm-) thick, stainless-steel sheet.
    - a. 0.108-inch- (2.74-mm-) thick, galvanized-steel sheet may be used at interior walls unless otherwise indicated.
  2. Tie Section: Triangular-shaped wire tie made from 0.25-inch- (6.35-mm-) diameter, hot-dip galvanized steel wire.
  3. Corrugated-Metal Ties: Metal strips not less than 7/8 inch (22 mm) wide with corrugations having a wavelength of 0.3 to 0.5 inch (7.6 to 12.7 mm) and an amplitude of 0.06 to 0.10 inch (1.5 to 2.5 mm) made from 0.062-inch- (1.59-mm-) thick, stainless-steel sheet with dovetail tabs for inserting into dovetail slots in concrete.
- E. Rigid Anchors: Fabricate from steel bars 1-1/2 inches (38 mm) wide by 1/4 inch (6.35 mm) thick by 24 inches (610 mm) long, with ends turned up 2 inches (51 mm) or with cross pins unless otherwise indicated.

1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.

F. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist a 100-lbf (445-N) load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch (1.5 mm).
2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.075-inch- (1.90-mm-) thick steel sheet, galvanized after fabrication.
3. Fabricate wire ties from 0.187-inch- (4.76-mm-) diameter, hot-dip galvanized-steel wire unless otherwise indicated.
4. Screw-Attached, Masonry-Veneer Anchors: Wire tie and a rib-stiffened, sheet metal anchor section with screw holes top and bottom, with projecting tabs having holes for inserting vertical legs of wire tie formed to fit anchor section.
  - a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) Heckmann Building Products, Inc.; 213 with 282.
    - 2) Hohmann & Barnard, Inc; HB-213.
    - 3) Wire-Bond; RJ-711 (#2401).
5. Seismic Masonry-Veneer Anchors: Connector section and rib-stiffened, sheet metal anchor section with screw holes top and bottom, with projecting tabs having slotted holes for inserting vertical leg of connector section. Connector section consists of a rib-stiffened, sheet metal bent plate with down-turned leg designed to fit in anchor section slot and with integral tabs designed to engage continuous wire.
  - a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) Hohmann & Barnard, Inc; [200/DA 213S.I.S.
    - 2) Wire-Bond; RJ-711 (#2401) with Wire-Bond clip.
6. Stainless-Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 (4.83-mm) diameter by length required to penetrate steel stud flange with not less than three exposed threads; either made from Type 410 stainless steel or made with a carbon-steel drill point and 300 Series stainless-steel shank.

## 2.9 EMBEDDED FLASHING MATERIALS

- A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
  1. Stainless Steel: ASTM A 240/A 240M or ASTM A 666, Type 304, 0.016 inch (0.40 mm) thick.



2. Fabricate continuous flashings in sections 96 inches (2400 mm) long minimum, but not exceeding 12 feet (3.7 m). Provide splice plates at joints of formed, smooth metal flashing.
3. Fabricate through-wall metal flashing embedded in masonry from stainless steel, with ribs at 3-inch (76-mm) intervals along length of flashing to provide an integral mortar bond.
4. Fabricate through-wall flashing with drip edge where indicated. Fabricate by extending flashing 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
5. Fabricate through-wall flashing with sealant stop unless otherwise indicated. Fabricate by bending metal back on itself 3/4 inch (19 mm) at exterior face of wall and down into joint 1/4 inch (6 mm) to form a stop for retaining sealant backer rod.
6. Fabricate metal drip edges from stainless steel. Extend at least 3 inches (76 mm) into wall and 1/2 inch (13 mm) out from wall, with outer edge bent down 30 degrees and hemmed.
7. Fabricate metal expansion-joint strips from stainless steel to shapes indicated.
8. Solder metal items at corners.

B. Flexible Flashing: Use the following unless otherwise indicated:

1. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive rubberized-asphalt compound, bonded to a high-density, cross-laminated polyethylene film to produce an overall thickness of not less than 0.040 inch (1.02 mm).
  - a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) Carlisle Coatings & Waterproofing Inc; CCW-705-TWF Thru-Wall Flashing.
    - 2) GCP Applied Technologies Inc. (formerly Grace Construction Products); Perm-A-Barrier Wall Flashing.
    - 3) Heckmann Building Products, Inc.; No. 82 Rubberized-Asphalt Thru-Wall Flashing.
    - 4) Hohmann & Barnard, Inc; Sando-Seal.
    - 5) Polyguard Products, Inc.; Polyguard 400.
    - 6) W. R. Meadows, Inc; Air-Shield Thru-Wall Flashing.
    - 7) Wire-Bond; Aquaflash 500 #4120.
  - b. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

C. Application: Unless otherwise indicated, use the following:

1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a sealant stop or flexible flashing with a metal sealant stop.

4. Where flashing is fully concealed, use metal flashing or flexible flashing.
- D. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 "Sheet Metal Flashing and Trim."
- E. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.
- F. Termination Bars for Flexible Flashing: Stainless-steel sheet 0.019 inch by 1-1/2 inches (0.48 mm by 38 mm) with a 3/8 inch (10-mm) sealant flange at top.

## 2.10 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- B. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).
- D. Weep/Cavity Vent Products: Use the following unless otherwise indicated:
  1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch (3 mm) less than depth of outer wythe, in color selected from manufacturer's standard.
    - a. Products: Subject to compliance with requirements, provide one of the following:
      - 1) Advanced Building Products Inc.; Mortar Maze Cell Vent.
      - 2) Heckmann Building Products, Inc.; No. 85 Cell Vent.
      - 3) Hohmann & Barnard, Inc; QV Quadro-Vent.
      - 4) Wire-Bond; Cell Vent (#3601).
- E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Advanced Building Products Inc.; Mortar Break DT.
    - b. Heckmann Building Products, Inc.; Weep-Thru Mortar Deflector.
    - c. Hohmann & Barnard, Inc; Mortar Trap.
    - d. Mortar Net Solutions; Mortar Net with Insect Barrier.

- e. Wire-Bond; Cavity Net DT.
2. Configuration: Provide one of the following:
- a. Strips, full depth of cavity and 10 inches (250 mm) high, with dovetail-shaped notches 7 inches (175 mm) deep that prevent clogging with mortar droppings.

## 2.11 MASONRY-CELL FILL

- A. Foam-Fill Amino-Plast Insulation: Cellular plastic insulation comprised of a spray-dried resin and a foam catalyst concentrate that are combined with water for injection, along with compressed air, into wall cavity.
- 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. cfiFoam, Inc.; Core Foam Masonry Insulation
    - b. Tailored Chemical Products; Core-Fill 500
  - 2. Surface Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
    - a. Flame-Spread Index: 25 or less.
    - b. Smoke-Developed Index: 450 or less.
  - 3. ASTM C 177, minimum R-value at 1-inch (25.4 mm) thickness of 4.5 deg F x h x sq. ft./BTU at 75 deg F (31 K x sq. m/w at 24 deg C).

## 2.12 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
- 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Diedrich Technologies, Inc.; a Hohmann & Barnard company; 202 New Masonry Detergent.
    - b. EaCo Chem, Inc.; NMD 80.
    - c. PROSOCO, Inc; Sure Klean® 600.

## 2.13 MORTAR AND GROUT MIXES

- A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
  2. Use portland cement-lime or masonry cement mortar unless otherwise indicated.
  3. For reinforced masonry, use portland cement-lime mortar.
  4. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.
- C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
1. For masonry below grade or in contact with earth, use Type M.
  2. For reinforced masonry, use Type S.
  3. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.
- D. Pigmented Mortar: Use colored cement product.
1. Mix to match Architect's sample.
  2. Application: Use pigmented mortar for exposed mortar joints with the following units:
    - a. Clay face brick.
- E. Grout for Unit Masonry: Comply with ASTM C 476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
  2. Proportion grout in accordance with ASTM C 476, paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi (14 MPa).
  3. Provide grout with a slump of 8 to 11 inches (200 to 280 mm) as measured according to ASTM C 143/C 143M.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
  2. Verify that foundations are within tolerances specified.
  3. Verify that reinforcing dowels are properly placed.

4. Verify that substrates are free of substances that impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.
- F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested according to ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

### 3.3 TOLERANCES

- A. Dimensions and Locations of Elements:
  1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch (12 mm) or minus 1/4 inch (6 mm).
  2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch (12 mm).
  3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch (6 mm) in a story height or 1/2 inch (12 mm) total.
- B. Lines and Levels:
  1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.
  2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.

3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 1/2-inch (12-mm) maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet (6 mm in 3 m), 3/8 inch in 20 feet (9 mm in 6 m), or 1/2-inch (12-mm) maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet (6 mm in 3 m), or 1/2-inch (12-mm) maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch (1.5 mm) except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm), with a maximum thickness limited to 1/2 inch (12 mm).
2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).
3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch (9 mm) or minus 1/4 inch (6 mm).
4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch (3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3 mm).
5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch (1.5 mm) from one masonry unit to the next.

### 3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in bond pattern indicated on Drawings; do not use units with less-than-nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 2 inches (50 mm). Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout 24 inches (600 mm) under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
  - 1. Install compressible filler in joint between top of partition and underside of structure above.
  - 2. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch (13-mm) clearance between end of anchor rod and end of tube. Space anchors 48 inches (1200 mm) o.c. unless otherwise indicated.
  - 3. Wedge nonload-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
  - 4. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 078443 "Joint Firestopping."

### 3.5 MORTAR BEDDING AND JOINTING

- A. Lay CMUs as follows:
  - 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
  - 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
  - 3. Bed webs in mortar in grouted masonry, including starting course on footings.
  - 4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
  - 5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

- E. Cut joints flush where indicated to receive waterproofing or air barriers unless otherwise indicated.

### 3.6 CAVITY WALLS

- A. Bond wythes of cavity walls together as follows:

1. Individual Metal Ties: Provide ties as shown installed in horizontal joints, but not less than one metal tie for 1.77 sq. ft. (0.16 sq. m) of wall area spaced not to exceed 16 inches (406 mm) o.c. horizontally and 16 inches (406 mm) o.c. vertically. Stagger ties in alternate courses. Provide additional ties within 12 inches (305 mm) of openings and space not more than 36 inches (915 mm) apart around perimeter of openings. At intersecting and abutting walls, provide ties at no more than 24 inches (610 mm) o.c. vertically.
  - a. Where bed joints of wythes do not align, use adjustable-type (two-piece-type) ties.
  - b. Where one wythe is of clay masonry and the other of concrete masonry, use adjustable-type (two-piece-type) ties to allow for differential movement regardless of whether bed joints align.
2. Header Bonding: Provide masonry unit headers extending not less than 3 inches (76 mm) into each wythe. Space headers not more than 8 inches (203 mm) clear horizontally and 16 inches (406 mm) clear vertically.
3. Masonry-Veneer Anchors: Comply with requirements for anchoring masonry veneers.

- B. Bond wythes of cavity walls together using bonding system indicated on Drawings.

- C. Keep cavities clean of mortar droppings and other materials during construction. Bevel beds away from cavity, to minimize mortar protrusions into cavity. Do not attempt to trowel or remove mortar fins protruding into cavity.

- D. Installing Cavity Wall Insulation: Place small dabs of adhesive, spaced approximately 12 inches (300 mm) o.c. both ways, on inside face of insulation boards. Fit courses of insulation between wall ties and other confining obstructions in cavity, with edges butted tightly both ways. Press units firmly against inside wythe of masonry or other construction as shown.

1. Fill cracks and open gaps in insulation with crack sealer compatible with insulation and masonry.
2. Use adhesive approved by air barrier manufacturer for this application.

### 3.7 ANCHORED MASONRY VENEERS

- A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:



1. Fasten screw-attached anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
  2. Embed tie sections in masonry joints.
  3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.
  4. Space anchors as indicated, but not more than 16 inches (406 mm) o.c. vertically and horizontally, with not less than one anchor for each 1.77 sq. ft. (0.16 sq. m) of wall area. Install additional anchors within 12 inches (305 mm) of openings and at intervals, not exceeding 8 inches (203 mm), around perimeter.
- B. Provide not less than 2 inches (50 mm) of airspace between back of masonry veneer and face of insulation.
1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

### 3.8 MASONRY-CELL FILL

- A. All empty core cells and voids within each insulated wall shall be filled with foam insulation as indicated on Drawings.
- B. Wall to be foam filled using pressure-injection techniques.
1. Pressure-Injection: holes shall be drilled in each cmu, 3/8 inch (10 mm) holes for visually sensitive areas for use with low-volume touch-up gun, 5/8 inch (16 mm) holes for use with a standard foam gun, or 7/8 inch (22 mm) for use with high-volume production gun, at 48 inches (1220 mm) from finished floor level.
  2. Foam insulation shall be injected until cells and voids are completely filled at each vertical cell column, as evidenced by foam exiting adjacent injection holes every 8 inches (203 mm). Injection shall be repeated at intervals of 10 to 14 feet (3 m to 4.2 m) above initial row of injection holes, or as needed, until wall is completely filled. Exit holes may be drilled beneath bond beams and at top of walls to help visually verify complete foam filling.
  3. After foam insulation sets, remove excess foam from outside of cavity, sweeping the wall and floor as needed. Cured foam is an inert material and, therefore, can be disposed of with other construction waste.
  4. Patch holes with mortar to match adjacent surface.

### 3.9 MASONRY-JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch (16 mm) on exterior side of walls, 1/2 inch (13 mm) elsewhere. Lap reinforcement a minimum of 6 inches (150 mm).
1. Space reinforcement not more than 16 inches (406 mm) o.c.
  2. Space reinforcement not more than 8 inches (203 mm) o.c. in foundation walls and parapet walls.

3. Provide reinforcement not more than 8 inches (203 mm) above and below wall openings and extending 12 inches (305 mm) beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

### 3.10 ANCHORING MASONRY TO STRUCTURAL STEEL

- A. Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:
  1. Provide an open space not less than 2 inches (50 mm) wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
  2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
  3. Space anchors as indicated, but not more than 24 inches (610 mm) o.c. vertically and 36 inches (915 mm) o.c. horizontally.

### 3.11 CONTROL AND EXPANSION JOINTS

- A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:
  1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
  2. Install preformed control-joint gaskets designed to fit standard sash block.
- C. Form expansion joints in brick as follows:
  1. Build in compressible joint fillers where indicated.
  2. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch (10 mm) for installation of sealant and backer rod specified in Section 079200 "Joint Sealants."
- D. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 079200 "Joint Sealants," but not less than 3/8 inch (10 mm).

1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

### 3.12 LINTELS

- A. Install steel lintels where indicated.
- B. Provide concrete or masonry lintels where shown and where openings of more than 12 inches (305 mm) for brick-size units and 24 inches (610 mm) for block-size units are shown without structural steel or other supporting lintels.
- C. Provide minimum bearing of 8 inches (200 mm) at each jamb unless otherwise indicated.

### 3.13 FLASHING, WEEP HOLES, AND CAVITY VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.
- B. Install flashing as follows unless otherwise indicated:
  1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
  2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 8 inches (200 mm), and 1-1/2 inches (38 mm) into the inner wythe.
  3. At masonry-veneer walls, extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches (200 mm); with upper edge tucked under water-resistive barrier or air barrier, lapping at least 4 inches (100 mm). Fasten upper edge of flexible flashing to sheathing through termination bar.
  4. At lintels and shelf angles, extend flashing a minimum of 6 inches (150 mm) into masonry at each end. At heads and sills, extend flashing 6 inches (150 mm) at ends and turn up not less than 2 inches (50 mm) to form end dams.
  5. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch (13 mm) back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
  6. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.
- C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
- D. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.

1. Use specified weep/cavity vent products to form weep holes.
  2. Space weep holes 24 inches (600 mm) o.c. unless otherwise indicated.
  3. Cover cavity side of weep holes with plastic insect screening at cavities insulated with loose-fill insulation.
- E. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

### 3.14 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
  2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.
- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
  2. Limit height of vertical grout pours to not more than 60 inches (1520 mm).

### 3.15 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.
- B. Inspections: Special inspections according to Level B in TMS 402/ACI 530/ASCE 5.
1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
  2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
  3. Place grout only after inspectors have verified proportions of site-prepared grout.
- C. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.

- D. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
- E. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.
- F. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

### 3.16 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
  - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
  - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
  - 3. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

### 3.17 MASONRY WASTE DISPOSAL

- A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.
- B. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.
- C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 042000

## SECTION 042113 – THIN BRICK VENEER

## PART 1 - GENERAL

## 1.1 SECTION INCLUDES

- A. Thin brick veneer and accessories.

## 1.2 RELATED SECTIONS

- A. 05 40 00 Cold-Formed Metal Framing

## 1.3 REFERENCES

- A. ASTM C 67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
- B. ASTM D 1056 - Standard Specification for Flexible Cellular MaterialsSponge or Expanded Rubber
- C. ASTM C 1088 - Standard Specification for Thin Veneer Brick Units Made from Clay or Shale
- D. BIA TN 28C - Technical Notes on Brick Construction, Thin Brick Veneer

## 1.4 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Product Data: Manufacturer's data sheets on each product to be used, including
  - 1 Preparation instructions and recommendations
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
- C. Shop Drawings
  - 1. Submit general placing drawings to indicate unit sizes, layout and bond patterns, spacing, location and quantities of substrate reinforcement and connectors, and structural movement related to thin brick masonry veneer assemblies.
  - 2. Include overall dimensions, framed opening requirements and tolerances, adjacent construction, affected related work, expansion and contraction joint locations, accessories, and project specific details
- D. Selection Samples: For each exposed product to be used, furnish not less than five individual brick samples and as many as required by the brick manufacture to demonstrate full color range, and texture to be expected in the finished work

E.Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

F.Manufacturer's Certificates: Certify products meet or exceed specified requirements.

## 1.5 QUALITY ASSURANCE

A.Sourcing: All primary products specified in this section shall be supplied by a single manufacturer

B.Manufacturer Qualifications: 10 years' experience manufacturing similar products and with production capability to meet the Project schedule.

C. Installer Qualifications: Approved by the setting system manufacturer with minimum 2 years' experience installing similar products/

D. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.

1. Finish areas designated by Architect, minimum size 48 inches (1200 mm) long by 36 inches (914 mm) high.

2. Do not proceed with remaining work until workmanship and color are approved by Architect.

3. Refinish mock-up area as required to produce acceptable work.

4.Accepted mock-ups may remain as part of the completed work and will set the standard of acceptance for remaining work including bond, mortar, workmanship, appearance and project specific criteria indicated by the Architect.

## 1.6 PRE-INSTALLATION MEETING

A. . Convene at the Project site minimum two weeks prior to starting work of this section to discuss:

1. Method and sequence of masonry construction.

2. Special masonry details.

3. Standard of workmanship.

4. Quality control requirements.

5. Job organization.

## 1.7 DELIVERY, STORAGE, AND HANDLING

A.Deliver materials in the manufacturer's unopened packaging with manufacturer's identification and labels intact until ready for installation.

B.Store in accordance with the manufacturer's instructions and the following:

1. Store units off the ground in a clean, dry, well-ventilated area covered to prevent masonry units and related materials from getting saturated before installation.
  2. Protect from surface damage, mud, dust or materials likely to cause staining or other defects.
  3. Remove damaged or deteriorated materials from the Project site and replace with new materials to meet specified requirements.
- C. Handle materials in accordance with the manufacturer's instructions.

## 1.8 PROJECT CONDITIONS

- A. Walls to receive thin brick must be structurally sound with a deflection no less than L/240, plumb and flat within 1/4 inch (6 mm) per 10 feet (3 meters), with corners braced to meet code and design requirements and to alleviate shrinkage, raking, settling, and movement.
- B. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Meridian Brick®; Formerly Boral Bricks and Forterra Brick, which is located at: 6455 Shiloh Rd. Suite D; Alpharetta, GA 30005; Toll Free Tel: 866-259-6263; 800-263-6229; Email: request info (askmeridian@meridianbricks.com); Web: <https://www.meridianbrick.com> | <https://www.meridianbrick.ca> ; <https://www.authenticbrick.com>
- B. Substitutions: Not permitted.
- C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

### 2.2 THIN BRICK

- A. Thin Brick: ASTM C 1088, Type TBS, tested in accordance with ASTM C 67, as manufactured by Meridian Brick.
- B. Brick Color and Size
1. Selection By owner
- C. Shapes: Provide flats and corner shapes as required.
- D. Mortar Joint Thickness: 3/8 inch Standard unless otherwise indicated on the Drawings.
- E. Mortar Joint shape: Tooled concave unless otherwise indicated on the Drawings.



## 2.3 Accessories

- A. Setting System: Provide setting system complete including manufacturer's accessories including primers, transition and sealing tapes required. System shall Conform to requirements specified in BIA TN 28C and the thin brick manufacturer's recommendation:
- B. Setting System: Provide setting system complete including manufacturer's accessories including primers, transition and sealing tapes required. System shall Conform to requirements specified in BIA TN 28C and the thin brick manufacturer's recommendation:
  - 1. Metal Lath and Scratch (Thick Set) System.
  - 2. Masonry Veneer Installation System (MVIS) over cementitious substrate (Thin Set System)
  - 3. Tabs Wall System, LLC proprietary system
  - 4. Best Panel System, LLC proprietary system
  - 5. Speedy Mason, Inc proprietary system
- C. Cleaners: Compatible with substrate and acceptable to masonry manufacturer.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Do not begin installation until backup structure and substrates have been properly prepared.
- B. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### 3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Protect adjacent materials from damage due to masonry work
- C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

### 3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions and BIA TN 28C - Technical Notes on Brick Construction, Thin Brick Veneer.
- B. Coordinate with Work specified in Section - Air Barriers and Section 07 27 00 - Air Barriers Water Resistive Barriers.

C. Install products from a single manufacturer as specified above based on adjacent construction and substrates.

D. Coursing and Bond Patterns:

1. Establish lines, levels, coursing and bond patterns indicated. Protect from displacement.

2. Maintain masonry courses to uniform dimensions. Form vertical and horizontal joints of uniform thickness.

3. Refer to the Drawings for special details and treatments at corners, openings, and transitions. Maintain architectural alignments as indicated.

E. Mortar Mixing:

1. Mix mortar only in quantities needed for immediate use.

2. Measure materials by volume or equivalent weight, using the same measurement for each material and batch. Do not measure by shovel.

3. If mortar color is to be used, add in accordance with manufacturers recommendations. Ensure uniformity of mix and coloration.

4. Clean mixing boards and mechanical mixing machine between batches.

F. Mortar Joints: 3/8 inch (9.5 mm) thick unless otherwise indicated on the Drawings.

G. Mortar Joint Tooling:

1. Provide slightly concave tool joints when the mortar is thumbprint hard using non-rusting round jointer tools slightly larger than the joint width to smooth and compress mortar tightly against both sides of the joint.

2. Tool joints in a manner to ensure the durability of the building envelope and not retain water or dirt.

3. Head joints shall match bed joint profile.

4. Tool all exterior joints below grade.

5. Flush cut all joints that are not tooled only where permitted by the Architect.

6. After tooling, cut off mortar tailings with a trowel and brush mortar burrs and dust from the face of the brick.

H. Sealant Recesses:

1. Leave joints around outside perimeters of exterior doors, window frames, and other wall openings a uniform depth of 3/4 inch (19 mm) and 1/4 to 3/8 inch (6 to 10 mm) wide.

### 3.4 CLEANING

- A. Leave work areas clean at the end of each day.
- B. Cut out defective mortar joints and holes in exposed masonry and re-point with mortar.
- C. Clean new masonry to remove excess mortar from the face of the brick as the Work progresses.
  - 1. Clean shortly after laying, the same day if possible, by wiping off the excess mortar using a bristle brush.
  - 2. Wash down with water and a brush the same or next day,
  - 3. Use chemical cleaners only as a last resort. Before use test an inconspicuous area at least 20 square feet (2 square meters), allow to dry 3 to 7 days. Inspect to ensure the mortar is not softened, brick or mortar are not discolored, and cleaner does not bring salts to the surface of the brick. If approved clean brick as follows:
    - a. Follow brick manufacturers recommendations and BIA Technical Note 20.
    - b. Wet surface of masonry prior to cleaning.
    - c. Scrub with acceptable cleaning agent, avoiding mortar joints.
    - d. Follow wait time suggested by manufacturer before rinsing with clear water.
    - e. Do only small sections at a time.
    - f. Work from top to bottom, insuring that lower portion of wall is thoroughly wetted when cleaning the upper portion.
    - g. Protect all sash, glass, metal lintels and other corrodible parts when masonry is cleaned with acid or caustic solution.
    - h. Upon completion, rinse thoroughly to remove surplus materials.

### 3.5 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

## SECTION 044313.16 – ADHERED STONE MASONRY VENEER

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section Includes:
  - 1. Stone masonry adhered to cold-formed metal framing and sheathing.

## 1.3 ACTION SUBMITTALS

- A. Product Data: For each variety of stone, stone accessory, and manufactured product.
- B. Samples for Verification:
  - 1. For each stone type indicated. Include Samples in each set to show the full range of color and other visual characteristics in completed Work.
  - 2. For each color of mortar required.

## 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- B. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, in a dry location, or in covered weatherproof dispensing silos.

## 1.5 COORDINATION

- A. Advise installers of other work about specific requirements for placement of flashing and similar items to be built into stone masonry.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations for Stone: Obtain each variety of stone, from single quarry with resources to provide materials of consistent quality in appearance and physical properties.
- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of uniform quality for each cementitious component from single manufacturer and each aggregate from single source or producer.

### 2.2 FIELDSTONE

- A. Manufacturer
  - 1. **Basis-of-Design Product:** Provide product indicated on Drawings.
- B. Color: As indicated on the Drawings.
- C. Pattern: As indicated on the Drawings.
- D. Corner Pieces: Precut L shape corner pieces for use at all outside corners.

### 2.3 MORTAR MATERIALS

- A. Mortar:
  - 1. Cement: ASTM C 270.
  - 2. Lime: ASTM C 207.
  - 3. Sand: ASTM C 144, natural or manufactured.
  - 4. Color Pigments: ASTM C 979, mineral oxide.
  - 5. Water: Potable.
  - 6. Pre-Packaged Latex-Portland Cement Mortar: ANSI A118.4.
- B. Bonding Agent: Acrylic additive.

### 2.4 MISCELLANEOUS MASONRY ACCESSORIES

- A. Expanded Metal Lath: 3.4 lb/sq. yd. (1.8 kg/sq. m), self-furring, diamond-mesh lath complying with ASTM C 847. Fabricate from structural-quality, zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G60 (Z180).
- B. Lath Attachment Devices: Material and type required by ASTM C 1063 for installations indicated.
- C. Building Paper: ASTM D 226, No. 30 asphalt saturated felt.

- D. House Wrap: Air/vapor barrier polymetric membrane as specified in Section \_\_\_\_ .

## 2.5 MORTAR MIXES

### A. Grouted Joints:

1. Mix Mortar: ASTM C 270, Type S.
2. Add color pigments to mortar in accordance with pigment manufacturer's instructions.

### B. Jointless Dry-Stack Installation:

1. Mix mortar in accordance with ANSI A118.4.
2. Add color pigments in accordance with pigment manufacturer's instructions.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine surfaces indicated to receive stone masonry, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of stone masonry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.
- B. Prepare for Installation Over Plywood, Gypsum, or other exterior grade sheathing:
  1. Water Resistant Barriers: Cover sheathing with combination of House Wrap (first) and Building Paper with joints lapped shingle style a minimum of 4 inches (102 mm).
  2. Metal Lath:
    - a. Install metal lath in accordance with ASTM C 1063.
    - b. Apply metal lath with long dimension perpendicular to supports and with joints lapped a minimum of 1 inch (25 mm).
    - c. Secure laps with tie wire where they occur between supports.
    - d. Stop lath 1 inch (25 mm) from finished edges.

## C. Application of Base Coat Stucco:

1. Apply scratch coat in accordance with PCA Plaster (Stucco) Manual.
2. Apply scratch coat to nominal thickness of 1/2 inch to 3/4 inch (13 mm to 19 mm) over metal lath surfaces.
3. If weather is hot or surface is dry, dampen previous coat before applying mortar and thin stone veneer.
4. If scratch coat is done in advance, use notch trowel to create texture for better bond. Smooth surface is not acceptable for bond.

## 3.3 SETTING STONE MASONRY

## A. Perform necessary field cutting and trimming as stone is set.

1. Use power saws to cut stone that is fabricated with saw-cut surfaces. Cut lines straight and true, with edges eased slightly to prevent snapping.
2. Use hammer and chisel to split stone that is fabricated with split surfaces. Make edges straight and true, matching similar surfaces that were shop or quarry fabricated.
3. Pitch face at field-split edges as needed to match stones that are not field split.

## B. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.

## C. Arrange stones with color and size variations uniformly dispersed for an evenly blended appearance.

## D. Set stone to comply with requirements indicated on Drawings. Install supports, fasteners, and other attachments indicated or necessary to secure stone masonry in place. Set stone accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.

## E. Maintain uniform joint widths except for variations due to different stone sizes and where minor variations are required to maintain bond alignment if any. Lay walls with joints of 1/2 inch (13 mm).

## F. Provide sealant joints of widths and at locations indicated.

1. Keep sealant joints free of mortar and other rigid materials.
2. Sealing joints is specified in Section 079200 "Joint Sealants."

## 3.4 INSTALLATION OF ADHERED STONE MASONRY VENEER

## A. Install thin veneer stone and mortar in accordance with manufacturer's instructions and ACI 530.1/ASCE 6/TMS 602.

## B. Maintain masonry courses to uniform dimensions. Form vertical and horizontal joints of uniform thickness.

## C. Pattern Bond:

1. Lay stone with face exposed.
2. Maintain approximate 1/2-inch (13-mm) joint, as stone allows.
3. Do not use stacked vertical joints.

## D. Placing and Bonding:

1. Dampen substrate as required to reduce excessive suction.
2. Apply mortar in accordance with PCA Plaster (Stucco) Manual to thickness of 1/2 inch to 3/4 inch (13 mm to 19 mm).
3. Do not spread more than workable area of 5 to 10 square feet, so mortar will not set before stone is applied.
4. Lay thin veneer stone in full bed of mortar with full head joints.
5. Work from bottom up, laying corner pieces first.
6. Remove excessive mortar as work progresses.
7. Do not shift or tap veneer stone after mortar has achieved initial set. Where adjustment is required, remove mortar and replace.
8. Isolate top of veneer stone from horizontal structural framing members and slabs or decks with compressible joint filler and sealant as specified in Section 07900.

## E. Joining Work: Where fresh masonry joins partially set masonry.

1. Remove loose stone and mortar.
2. Clean and lightly wet surface of set masonry.
3. To avoid horizontal run of masonry, rack back 1/2 the length of stone in each course.
4. Tothing is not permitted.

## F. Joints:

1. Lay stone with approximate 1/2-inch (13-mm) mortar joint, as stone allows.
2. Tool joints when "thumb-print" hard with round jointer, slightly larger than width of joint.
3. Trowel point or concave tool exterior joints below grade.
4. Flush cut joints to be finished with soft brush only.
5. Retempering of mortar is not permitted.
6. Use non-corrosive stone shims as required to maintain uniform joint thickness.

## G. Control and Expansion Joints:

1. Keep joints open and free of debris.
2. Coordinate control joints as specified in Section 07900 for sealant performance.

## H. Sealant Recesses:

1. Provide open joints 3/4 inch (19 mm) deep and 1/4 inch (6 mm) wide, where masonry meets doors, windows, and other exterior openings.
2. Coordinate sealant joints as specified in Section 07900 (07 90 00) for sealant performance.



## I. Cutting and Fitting:

1. Cut and fit thin veneer stone for chases, pipes, conduit, sleeves, grounds, and other penetrations and adjacent materials.
2. Coordinate with other work to provide correct size, shape, and location.

## J. During progress of the work, cover top of unfinished stone masonry work for protection from weather.

## 3.5 ADJUSTING AND CLEANING

- A. If residual mortar is on face of stone, allow to dry partially and brush mortar off surface and sponge off residue.
- B. When work is completed and mortar has set for 2 to 3 days, clean surface from top to bottom using mild masonry detergent acceptable to natural thin veneer stone manufacturer.
- C. Do not use harsh cleaning materials or methods that could damage stone.
- D. Do not use metal brushes or acids for cleaning.

## 3.6 PROTECTION

- A. Protect installed natural thin veneer stone to ensure that, except for normal weathering, stone will be without damage or deterioration at time of Substantial Completion.
- B. Touch-up, repair, or replace damaged stone before Substantial Completion.

END OF SECTION 044313

## SECTION 051200 - STRUCTURAL STEEL FRAMING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Structural steel.
  - 2. Grout.

- B. Related Sections:

- 1. Division 01 Section "Structural Testing and Special Inspection Services" for Fabricator's Certificate of Compliance and quality control.
  - 2. Division 05 Section "Steel Decking" for field installation of shear connectors through deck.
  - 3. Division 05 Section "Metal Fabrications" for miscellaneous steel fabrications and other metal items not defined as structural steel.
  - 4. Division 05 Section "Metal Stairs."
  - 5. Division 09 painting Sections for surface-preparation, priming and shop painting requirements.

#### 1.3 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Connection design information: in accordance with ANSI/AISC 303, structural steel connections are a deferred submittal per Option 3B, unless noted as an Option 1 or Option 2 connection, including comprehensive engineering design by a qualified professional engineer licensed in the project state.
  - 1. Option 1: Connection designs which have been completed and are indicated as such on the Drawings.
  - 2. Option 2: Connections which can be selected or completed by an experienced steel detailer.

3. Option 3 and 3B: Connection designs and final configurations of member reinforcement at connections designed by fabricator's qualified professional engineer.
  - a. Use Load and Resistance Factor Design; data is given at factored-load level.
- B. Moment Connections: Type FR, fully restrained.
- C. Construction: Moment frame/Shear wall system.

## 1.5 ACTION 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. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
  4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
  5. Indicate headed stud and deformed bar anchor (DBA) layout and placement.
- C. Deferred Submittal: For structural-steel connections indicated on Drawings to comply with design loads, include analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified professional engineer, installer and fabricator, including copies of fabricator's AISC Certification.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Mill test reports for structural steel, including chemical and physical properties.
- E. Product Test Reports and Certifications: For the following:
  1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
  2. Direct-tension indicators.
  3. Tension-control, high-strength bolt-nut-washer assemblies.
  4. Anchor Rods.
  5. Welding Consumables for Field Welds
  6. Shear stud connectors.

- 7. Shop primers.
- 8. Nonshrink grout.
- F. Source quality-control reports including nondestructive testing (NDT) reports and AISC 360, Section N3.2 items 1 to 3, and 5 to 11.
- G. Fabricator Certificates: Fabricator's Certificate of Compliance per Division 1 Section "Special Inspections" at completion of fabrication signed by fabricator certifying that structural steel was fabricated in accordance with construction documents.
- H. Minutes of preinstallation conference

## 1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU (Certified Building Fabricator).
- B. Installer Qualifications: A company specializing in performing the work of this Section with a minimum of 10 years documented experience.
- C. Steel Detailer Qualifications: Connections not detailed on the Drawings shall be designed by the fabricator under the direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the Project state.
- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- E. Comply with applicable provisions of the following specifications and documents:
  - 1. AISC 303.
  - 2. AISC 360.
  - 3. RCSC's "Specification for Structural Joints Using High-Strength Bolts."
- F. Preinstallation Conference: Conduct conference at Project site.
  - 1. Include discussion of construction joints in slabs on steel deck.

## 1.8 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 corrosion and deterioration.
  - 1. 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.

- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
  - 1. Fasteners may be repackaged provided the Testing/Inspecting Agency observes repackaging and seals containers.
  - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
  - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

## 1.9 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of 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. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than the following:
  - 1. W-Shapes: 60 percent.
  - 2. Channels, Angles, M , S-Shapes: 60 percent.
  - 3. Plate and Bar: 25 percent.
  - 4. Cold-Formed Hollow Structural Sections: 25 percent.
  - 5. Steel Pipe: 25 percent.
  - 6. All Other Steel Materials: 25 percent.
- B. W-Shapes: ASTM A 992.
- C. Channels, Angles, M, S-Shapes: ASTM A 36.
- D. Plate and Bar: ASTM A 36. Use ASTM A 572, Grade 50 where indicated on the Drawings.
- E. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade C, structural tubing.
- F. Steel Pipe: ASTM A 53, Type E or S, Grade B.
  - 1. Weight Class: As indicated on the Drawings.
  - 2. Finish: Black except where indicated to be galvanized.
- G. Welding Electrodes: Comply with AWS requirements.

## 2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.
  - 1. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with plain finish.
- B. High-Strength Bolts, Nuts, and Washers: ASTM A 490, Type 1, heavy-hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers with plain finish.
  - 1. Direct-Tension Indicators: ASTM F 959, Type 490, compressible-washer type with plain finish.
- C. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers.
  - 1. Finish: Hot-dip zinc coating.
  - 2. Direct-Tension Indicators: ASTM F 959, Type 325, compressible-washer type with mechanically deposited zinc coating finish.
- D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
  - 1. Finish: Plain, unless noted otherwise.
- E. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B, with arc shields.
- F. Unheaded Anchor Rods: ASTM F 1554, Grade 55, weldable, or ASTM F 1554, Grade 105, as indicated on the Drawings.
  - 1. Configuration: Straight.
  - 2. Nuts: ASTM A 563 heavy-hex carbon steel.
  - 3. Plate Washers: ASTM A 36 carbon steel.
  - 4. Washers: ASTM F 436, Type 1, hardened carbon steel.
  - 5. Finish: Plain, unless noted otherwise.
  - 6. Anchor rods to be galvanized shall have the end of the anchor rod intended to project from the concrete die stamped with the grade identification as required by supplement S3.
- G. Deformed Bar Anchors (DBA): ASTM A 1064, Grade 60 minimum.
- H. Threaded Rods: ASTM A 36.
  - 1. Nuts: ASTM A 563 heavy-hex carbon steel.

2. Washers: ASTM F 436, Type 1, hardened carbon steel.
3. Finish: Plain, unless noted otherwise.

- I. Clevises and Turnbuckles: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1035.
- J. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.
- K. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.

## 2.3 PRIMER

- A. Primer for High Performance Coatings or other finish coats: Comply with Division 09 painting Sections.
- B. Primer for all other uses: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- C. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

## 2.4 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and 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 360.
  1. Camber structural-steel members where indicated.
  2. Fabricate beams with rolling camber up.
  3. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
  4. Mark and match-mark materials for field assembly.
  5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. 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/D1.1M.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning."
- F. 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/D1.1M and manufacturer's written instructions.
- G. Holes: Provide holes required for securing other work to structural steel and for other work to pass 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 High-Strength Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type: As indicated on the Drawings.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

## 2.7 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.
  - 2. Surfaces to be field welded.
  - 3. Surfaces to receive composite shear studs.
  - 4. Surfaces to be high-strength bolted with slip-critical connections.
  - 5. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
  - 6. 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 3, "Power Tool Cleaning." For steel not receiving a finish coat and not subjected to extended weathering.
  2. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning." For steel receiving a finish coat or subject to extended weathering.
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 2.5mils. 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 surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

## 2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123.
1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
  2. Galvanize lintels and shelf angles attached to structural-steel frame and located in exterior walls.
  3. Galvanize exposed structural steel where indicated on drawings.

## 2.9 SOURCE QUALITY CONTROL

- A. Fabricator Quality Control: Fabricator quality control shall be in accordance with AISC 360, Chapter N. Submit test reports and certifications listed in AISC 360, Section N3.2 for review by Special Inspector. Fabricator shall pay for and provide nondestructive testing (NDT) of all complete joint penetration shop welds by ultrasonic inspection per ASTM E 164. NDT shall be performed by NDT testing personnel qualified in accordance with AISC 360 Section N4.3. Submit NDT reports.
- B. Testing Agency: Owner will engage an independent Testing/Inspecting Agency to perform a shop visit to observe compliance with the AISC Quality Certification Program.
1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- C. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.
- D. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using High-Strength Bolts."

- E. Welded Connections: In addition to visual inspection of all shop welds, all full penetration welds in materials 5/16" thick or greater shall be ultrasonic tested and inspected according to AWS D1.1/D1.1M and ASTM E 164.
- F. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1/D1.1M 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/D1.1M.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
  - 1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.
- 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.

#### 3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Base Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials and roughen surfaces prior to setting plates. Clean bottom surface of plates.
  - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
  - 2. Weld plate washers to top of base plate where indicated.
  - 3. Snug-tighten 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 plate before packing with grout.

4. Promptly pack grout solidly between bearing surfaces and 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 within AISC's "Code of Standard Practice for Steel Buildings and Bridges." Edge angles and bent plates, masonry ledgers and other miscellaneous fascia support steel shall be erected to meet the tolerance requirements for Adjustable Items.
- D. Align and adjust various members that form 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.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.
- H. Shear Connectors and Deformed Bar Anchors (DBA): Prepare steel surfaces as recommended by manufacturer. Use automatic end welding according to AWS D1.1/D1.1M 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 High-Strength Bolts" for type of bolt and type of joint specified.
  1. Joint Type: As indicated on the Drawings.
- B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.

### 3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent Testing/Inspecting Agency to inspect field welds and high-strength bolted connections in accordance with Division 01 Section "Structural Testing and Special Inspection Services" and AISC 360, Chapter N.

- B. Bolted Connections: Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using High-Strength Bolts."
- C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.
  - 1. In addition to visual inspection of all field welds, all full penetration welds in materials 5/16" thick or greater will be ultrasonic tested and inspected according to AWS D1.1/D1.1M and ASTM E 164.
- D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M 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/D1.1M.
- E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

### 3.6 REPAIRS AND PROTECTION

- A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.
- B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  - 1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
- C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 painting Sections.

END OF SECTION 051200

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## SECTION 053100 - STEEL DECKING

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Roof deck.
  - 2. Composite floor deck.
- B. Related Sections include the following:
  - 1. Division 01 Section "Structural Testing and Special Inspection Services" for field quality control.
  - 2. Division 03 Section "Cast-in-Place Concrete" for concrete fill.
  - 3. Division 05 Section "Structural Steel Framing" for steel angle framing and shop- and field-welded shear connectors.
  - 4. Division 09 painting Sections for repair painting of primed deck.

## 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

## 1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of steel deck, signed by product manufacturer.
- B. Welding certificates.

## 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A Member of the Steel Deck Institute.

- B. Installer Qualifications: An experienced installer who has completed steel deck similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Welding: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."
- D. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."
- E. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Manufacturers offering products that may be incorporated into the Work include the following:
  - 1. Steel Deck:
    - a. ASC Steel Deck
    - b. Canam Steel Corp.; The Canam Manac Group.
    - c. Epic Metals Corporation.
    - d. New Millennium Building Systems, LLC.
    - e. Nucor Corp; Verco Decking, Inc.
    - f. Nucor Corp.; Vulcraft Division.
    - g. Valley Joist; Division of EBSCO Industries, Inc.

### 2.2 ROOF DECK

- A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with ANSI/SDI-RD1.0 Standard for Steel Roof Deck, and with the following:
  - 1. Prime-Painted Steel Sheet: ASTM A 1008, Structural Steel (SS), Grade 33 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.

- a. Color: Manufacturer's standard.
2. Deck Profile: As indicated on the Drawings.
3. Profile Depth: As indicated on the Drawings.
4. Design Uncoated-Steel Thickness: As indicated on the Drawings.
5. Span Condition: As indicated on the Drawings.
6. Side Laps: Overlapped.

## 2.3 COMPOSITE FLOOR DECK

- A. Composite Steel Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with ANSI/SDI-C1.0 Standard for Composite Floor Deck, with the minimum section properties indicated, and with the following:
  1. Prime-Painted Steel Sheet: ASTM A 1008, Structural Steel (SS), Grade 33 minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
    - a. Color: Manufacturer's standard.
  2. Profile Depth: As indicated on the Drawings.
  3. Design Uncoated-Steel Thickness: As indicated on the Drawings.
  4. Span Condition: As indicated on the Drawings.

## 2.4 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- E. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.
- F. Column Closures, End Closures, and Z-Closures: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.
- G. Hips, Valleys, Ridge and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, 6" minimum in width, unless otherwise indicated.



- H. Flat Sump Plate: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.
- I. Galvanizing Repair Paint: ASTM A 780.
- J. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

### 3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable Standards and commentary in SDI Publication No. 31, Steel Deck Institute Design Manual, manufacturer's written instructions, and requirements in this Section.
- B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.
- C. Locate deck bundles to prevent overloading of supporting members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
- H. Provide hip, valley and ridge plates at all changes in deck plane orientation unless otherwise noted. Fasten to supporting deck at 12 inches on center, each side, unless noted otherwise.
- I. Provide cover plates where deck span changes direction unless otherwise noted. Fasten to supporting deck at 12 inches on center, each side, unless noted otherwise.
- J. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

### 3.3 ROOF-DECK INSTALLATION

- A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
  - 1. Weld Diameter: 5/8 inch, nominal.
  - 2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated on the Drawings.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals indicated on the Drawings but not exceeding the lesser of 1/2 of the span or 24 inches, and as follows:
  - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
  - 2. Fasten with a minimum of 1-1/2-inch long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
  - 1. End Joints: Lapped 2 inches minimum.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches apart with at least one fastener at each corner.
  - 1. Install reinforcing channels or zees in ribs to span between supports and mechanically fasten.
- E. Miscellaneous Roof-Deck Accessories: Install hip, ridge and valley plates, finish strips, end closures, cover plates and reinforcing channels according to deck manufacturer's written instructions unless noted otherwise. Weld or mechanically fasten to substrate to provide a complete deck installation.
- F. Roof Deck Openings: Steel deck openings shall be reinforced as follows:
  - 1. Steel deck openings 6" or less in size do not require reinforcing.
  - 2. Steel deck openings greater than 12" in size shall be reinforced with a structural steel frame as indicated on the Drawings.
  - 3. Steel deck openings greater than 6 inches but less than 12 inches in size shall be reinforced as follows, unless specifically detailed otherwise on the Drawings:
    - a. Install 2x2x1/4 inch structural steel angle each side of opening, perpendicular to the deck flutes and extending a minimum of two flutes beyond each side of the opening.
    - b. Weld or mechanically fasten each deck flute to the angles.
- G. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

- H. Hanging Loads: Do not hang loads from roof deck.

### 3.4 FLOOR-DECK INSTALLATION

- A. Fasten floor-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated and as follows:
  - 1. Weld Diameter: 5/8 inch, nominal.
  - 2. Weld Spacing: Space and locate welds as indicated on the Drawings.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, as indicated on the Drawings and at intervals not exceeding the lesser of half of the span or 24 inches, and as follows:
  - 1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
  - 2. Fasten with a minimum of 1-1/2-inch long welds.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches with end joints as follows:
  - 1. End Joints: Butted.
- D. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations, unless otherwise indicated.
- E. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

### 3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing agency to perform field tests and inspections and prepare test reports. See Division 01 Section “Structural Testing and Special Inspection Services.”
- B. Field welds will be subject to inspection.
- C. Testing/Inspection Agency will report inspection results promptly and in writing to Contractor and Architect.
- D. Remove and replace work that does not comply with specified requirements.
- E. Additional inspections, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

### 3.6 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
  - 1. Touch-up all welds with galvanizing repair paint.
- B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation and apply repair paint.
  - 1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
- C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Material Completion.

END OF SECTION 053100

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## SECTION 054000 - COLD-FORMED METAL FRAMING

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

## A. Section Includes:

1. Load-bearing wall framing.
2. Exterior non-load-bearing wall framing.
3. Floor joist framing.
4. Ceiling joist framing.
5. Soffit framing.

## B. Related Requirements:

1. Section 055000 "Metal Fabrications" for masonry shelf angles and connections.
2. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies.
3. Section 092216 "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

## 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

## 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of cold-formed steel framing product and accessory, include description of framing, load tables, span deflection tables, and installation data. Mark materials to indicate only products proposed for use & the relative Project application.
- B. Shop Drawings:
  1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.

2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
  3. Drawings shall indicate sequence and method of erection details of all connections of cold-formed steel framing to other elements of the building structure.
- C. Delegated-Design Submittal: For cold-formed steel framing. Include analysis data and shop drawings signed and sealed by a qualified professional engineer, licensed in the project state, responsible for their preparation.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Product Test Reports: For each listed product, for tests performed by a qualified testing agency.
1. Steel sheet.
  2. Expansion anchors.
  3. Power-actuated anchors.
  4. Mechanical fasteners.
  5. Vertical deflection clips.
  6. Horizontal drift deflection clips
  7. Miscellaneous structural clips and accessories.
- D. Research Reports: For non-standard cold-formed steel framing, from ICC-ES.

## 1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:
1. ClarkDietrich Building Systems.
  2. Marino\Ware.
  3. SCAFCO Corporation.
  4. United Metal Products, Inc.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.
- B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
1. Design Loads: As indicated.
  2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
    - a. Exterior Load-Bearing Wall Framing: Horizontal deflection of 1/360 of the wall height.
    - b. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft. (239 Pa).
    - c. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height.
    - d. Floor Joist Framing: Vertical deflection of 1/360 for live loads and 1/240 for total loads of the span.
    - e. Ceiling Joist Framing: Vertical deflection of 1/360 of the span for live loads and 1/240 for total loads of the span.
    - f. Non-load-bearing Masonry support framing: Restrict allowable out-of-plane deflection of steel studs to 1/720 using service level loads, per BIA Technical Note 28B
  3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).
  4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
    - a. Upward and downward movement of 1 inch (25 mm).



5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Design Standards:

1. Floor and Roof Systems: AISI S210.
2. Wall Studs: AISI S211.
3. Headers: AISI S212.
4. Lateral Design: AISI S213.

D. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.

E. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

## 2.3 COLD-FORMED STEEL FRAMING, GENERAL

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:

1. Grade: ST33H (ST230H), unless otherwise indicated.
2. Coating: G60 (Z180).

C. Steel Sheet for Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: 33 (230), unless otherwise indicated.
2. Coating: G60 (Z180).

## 2.4 LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0478 inch (1.21 mm), unless otherwise indicated.
2. Flange Width: 1-5/8 inches (41 mm).

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches (32 mm).

- C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:
  - 1. Minimum Base-Metal Thickness: 0.0478 inch (1.21 mm), unless otherwise indicated.
  - 2. Flange Width: 1-5/8 inches (41 mm).

## 2.5 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
  - 1. Minimum Base-Metal Thickness: As required by structural performance, but not less than 0.0478 inch (1.21 mm), unless otherwise indicated.
  - 2. Flange Width: As required by structural performance, minimum 1-5/8 inches (41 mm).
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
  - 1. Minimum Base-Metal Thickness: Matching steel studs.
  - 2. Flange Width: Manufacturer's standard, minimum 1-1/4 inches (32 mm).
- C. Vertical Deflection Clips: Manufacturer's standard clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ClarkDietrich Building Systems.
    - b. Marino\Ware.
    - c. SCAFCO Corporation.
    - d. The Steel Network, Inc.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
  - 1. Minimum Base-Metal Thickness: 0.0478 inch (1.09 mm), unless otherwise indicated.
  - 2. Flange Width: As required to accommodate deflection, but not less than 2-1/2 inch (63.5 mm).
- E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

## 2.6 FLOOR JOIST FRAMING

- A. Steel Joists: Manufacturer's standard C-shaped steel joists, of web depths indicated, punched, with stiffened flanges, and as follows:
  - 1. Minimum Base-Metal Thickness: 0.0478 inch (1.21 mm), unless otherwise indicated.
  - 2. Flange Width: 1-5/8 inches (41 mm), minimum.
  - 3. Section Properties: Refer to structural drawings, shop drawings and calculations.
- B. Steel Joist Track: Manufacturer's standard U-shaped steel joist track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
  - 1. Minimum Base-Metal Thickness: Matching steel joists.
  - 2. Flange Width: 1-1/2 inches (38 mm), minimum.

## 2.7 CEILING JOIST FRAMING

- A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, punched with standard holes, with stiffened flanges, and as follows:
  - 1. Minimum Base-Metal Thickness: 0.0478 inch (1.21 mm), unless otherwise indicated.
  - 2. Flange Width: 1-5/8 inches (41 mm), minimum.

## 2.8 SOFFIT FRAMING

- A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
  - 1. Minimum Base-Metal Thickness: 0.0478 inch (1.21 mm), unless otherwise indicated.
  - 2. Flange Width: 1-5/8 inches (41 mm), minimum.

## 2.9 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
  - 1. Supplementary framing.
  - 2. Bracing, bridging, and solid blocking.
  - 3. Web stiffeners.
  - 4. Anchor clips.
  - 5. End clips.
  - 6. Foundation clips.

7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole reinforcing plates.
11. Backer plates.

## 2.10 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel headless, hooked bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
- E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
  1. Head Type: Low-profile head beneath sheathing, manufacturer's standard pan head.
- F. Welding Electrodes: Comply with AWS standards.

## 2.11 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20.
- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30-minute working time.
- D. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.

- E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

## 2.12 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
  - 1. Fabricate framing assemblies using jigs or templates.
  - 2. Cut framing members by sawing or shearing; do not torch cut.
  - 3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
    - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by no fewer than three exposed screw threads.
  - 4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
  - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
  - 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.
- C. Install load bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch (6 mm) to ensure a uniform bearing surface on supporting concrete or masonry construction.
- D. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

### 3.3 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200 and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
  - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
  - 1. Cut framing members by sawing or shearing; do not torch cut.
  - 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
    - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    - b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 072100 "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.
- J. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960), 1/4 inch in any continuous wall, line, or surface, and as follows:
  - 1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
- K. Blocking: Provide intermediate runners and blocking to support edges of facing materials an built-in or attached construction.
- L. Cutting:
  - 1. Cutting for utilities: Do not remove, notch, cut, or relocate load-bearing studs or other structural members for utility installation or other cause without prior written approval of Architect.
  - 2. Cut-outs: Minimize cut-outs for utilities and bridging. Locate cut-outs near bottom, but not less than 12 inches from bottom track. No cut-outs allowed at mid-points or tie points.
  - 3. Perform cutting with a power-driven saw with an abrasive blade. No hand cutting will be permitted. Cuts shall be clean, accurate, and true to line.
- M. Attachment:
  - 1. Secure abutting and intersecting members using specified methods.
  - 2. Secure .0478 inch (1.21 mm) and lighter members using screws, .0598 inch (1.52 mm) and heavier by welding.
    - a. Screws:
      - 1) Comply with screw manufacturer's product data and ASTM C 954 for minimum spacing and edge distance requirements and for torque requirements.
      - 2) Screw penetration through joined materials shall be minimum of three exposed screw threads.

b. Welding:

- 1) Welds shall develop 1,000 psi minimum strength to structural framing, 500 psi minimum strength to other cold-formed metal framing components; comply with AWS methods and requirements.
- 2) Weld only .0598 inch (1.52 mm) and heavier members directly to structural framing; weld .0478 inch (1.21 mm) and lighter members to .0598 inch (1.52 mm) or heavier clips, then weld clips to structural framing.

c. Weld to adjacent steel construction whenever possible.

d. Screw or bolt to dissimilar construction and where welding is not possible or feasible.

### 3.4 LOAD-BEARING WALL INSTALLATION

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:

1. Anchor Spacing: 24 inches (610 mm) or as shown on Shop Drawings.

B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/16 inch (3 mm) between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:

1. Stud Spacing: As indicated.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

E. Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.

F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.

G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

1. Frame wall openings with not less than a double stud at each jamb of frame or as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.



- H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
  - 1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.
- I. Install horizontal bridging in stud system, spaced vertically 48 inches (1220 mm) or as indicated on Shop Drawings. Fasten at each stud intersection.
  - 1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches (150 mm) deep.
- J. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.
- K. Install triple studs at exterior corners.
- L. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

### 3.5 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Do not fasten studs to deflection track. Space studs as follows:
  - 1. Stud Spacing: As indicated.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
  - 1. Install single deep-leg deflection tracks and anchor to building structure.
  - 2. Connect vertical deflection clips to bypassing studs and anchor to building structure.
  - 3. Connect drift clips to cold-formed metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.

1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 18 inches (450 mm) of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
    - a. Install solid blocking at 96-inch (2440-mm) centers or indicated on Shop Drawings.
  2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
- F. Install triple studs at exterior corners.
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

### 3.6 JOIST INSTALLATION

- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.
- B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm).
  2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.
- C. Space joists not more than 2 inches (51 mm) from abutting walls, and as follows:
1. Joist Spacing: as indicated.
- D. Frame openings with built-up joist headers consisting of joist and joist track, or another combination of connected joists if indicated.
- E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on Shop Drawings.
1. Install web stiffeners to transfer axial loads of walls above.
- F. Install bridging at intervals indicated or as indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:
1. Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.

2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.
- G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.
- H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

### 3.7 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### 3.8 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

## SECTION 055000 - METAL FABRICATIONS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

## A. Section Includes:

1. Steel framing and supports for operable partitions.
2. Steel framing and supports for overhead doors.
3. Steel framing and supports for countertops.
4. Steel tube reinforcement for low partitions.
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. Elevator machine beams, hoist beams, and divider beams.
8. Steel shapes for supporting elevator door sills.
9. Metal ladders.
10. Ladder safety cages.
11. Metal ships' ladders.
12. Elevator pit sump covers.
13. Miscellaneous steel trim including steel angle corner guards, steel edgings, and loading-dock edge angles.
14. Metal bollards.
15. Downspout guards.

## B. Products furnished, but not installed, under this Section include the following:

1. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete.
2. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

## C. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
2. Section 051200 "Structural Steel Framing."

### 1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. 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.

### 1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Paint products.
  - 2. Grout.
- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
  - 1. Steel framing and supports for operable partitions.
  - 2. Steel framing and supports for overhead doors.
  - 3. Steel framing and supports for countertops.
  - 4. Steel tube reinforcement for low partitions.
  - 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. Elevator machine beams, hoist beams, and divider beams.
  - 8. Steel shapes for supporting elevator door sills.
  - 9. Metal ladders.
  - 10. Ladder safety cages.
  - 11. Metal ships' ladders.
  - 12. Elevator pit sump covers.
  - 13. Miscellaneous steel trim including steel angle corner guards, steel edgings, and loading-dock edge angles.
  - 14. Metal bollards.
  - 15. Downspout guards.
- C. Samples for Verification: For each type and finish of extruded nosing and tread.

### 1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

- C. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

## 1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

## 1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

## PART 2 - PRODUCTS

### 2.1 METALS

- 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.
- B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- C. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- D. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.
- E. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
  - 1. Size of Channels: 1-5/8 by 1-5/8 inches (41 by 41 mm) unless otherwise indicated.
  - 2. Material: Galvanized steel, ASTM A 653/A 653M, commercial steel, Type B, with G90 (Z275) coating; 0.079-inch (2-mm) nominal thickness.
  - 3. Material: Cold-rolled steel, ASTM A 1008/A 1008M, commercial steel, Type B; 0.0677-inch (1.7-mm) minimum thickness; coated with rust-inhibitive, baked-on, acrylic enamel.

### 2.2 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
  - 1. Provide stainless-steel fasteners for fastening aluminum.

2. Provide stainless-steel fasteners for fastening stainless steel.
  3. Provide stainless-steel fasteners for fastening nickel silver.
  4. Provide bronze fasteners for fastening bronze.
- 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. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3 (ASTM A 325M, Type 3); with hex nuts, ASTM A 563, Grade C3 (ASTM A 563M, Class 8S3); and, where indicated, flat washers.
- D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593 (ASTM F 738M); with hex nuts, ASTM F 594 (ASTM F 836M); and, where indicated, flat washers; Alloy Group 1 (A1).
- E. Anchors, General: Anchors capable of sustaining, 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/E 488M, conducted by a qualified independent testing agency.
- F. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; 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, all hot-dip galvanized per ASTM F 2329.
- G. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
  2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).
- H. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches (41 by 22 mm) by length indicated with anchor straps or studs not less than 3 inches (75 mm) long at not more than 8 inches (200 mm) o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

## 2.3 MISCELLANEOUS MATERIALS

- A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

- B. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.
- C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- D. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- G. Concrete: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).

## 2.4 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 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. Contour of welded surface to match that of adjacent surface for non-concealed steel installations.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.



- G. Fabricate seams and other connections that are 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.
- J. Where units are indicated to be cast into concrete, 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.

## 2.5 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.
  - 1. Fabricate units from slotted channel framing where indicated.
  - 2. Furnish inserts for units installed after concrete is placed.
- C. Fabricate supports for operable partitions from continuous steel beams of sizes recommended by partition manufacturer with attached bearing plates, anchors, and braces as recommended by partition manufacturer. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.
- D. Galvanize miscellaneous framing and supports where indicated.
- E. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

## 2.6 METAL LADDERS

- A. General:
  - 1. Comply with ANSI A14.3, except for elevator pit ladders.
  - 2. For elevator pit ladders, comply with ASME A17.1/CSA B44.
- B. Steel Ladders:
  - 1. Space siderails: 24 inches (610 mm) apart unless otherwise indicated.
  - 2. Siderails: Continuous, 3/8-by-2-1/2-inch (9.5-by-64-mm) steel flat bars, with eased edges.
  - 3. Rungs: 1-inch- (25-mm-) square, knurled steel bars.

4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. Provide platforms as indicated fabricated from welded or pressure-locked steel bar grating, supported by steel angles. Limit openings in gratings to no more than 1/2 inch (12 mm) in least dimension.
6. Support each ladder at top and bottom and not more than 48 inches (1219 mm) o.c. with welded or bolted steel brackets.
7. Prime ladders, including brackets and fasteners, with zinc-rich primer. **Primer specified in Section 099600 "High-Performance Coatings."**

## 2.7 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. Prime ladder safety cages, including brackets and fasteners, with zinc-rich primer. **Primer specified in Section 099600 "High-Performance Coatings."**

## 2.8 METAL SHIPS' LADDERS

### A. Provide metal ships' ladders where indicated. Fabricate of open-type construction with channel or plate stringers and pipe and tube railings unless otherwise indicated. Provide brackets and fittings for installation.

1. Treads shall be not less than 5 inches (127 mm) exclusive of nosing or less than 8-1/2 inches (216 mm) including the nosing, and riser height shall be not more than 9-1/2 inches (241 mm).
2. Fabricate ships' ladders, including railings from steel.
3. Fabricate treads and platforms from welded or pressure-locked steel bar grating. Limit openings in gratings to no more than 1/2 inch (12 mm) in least dimension.
4. Comply with applicable railing requirements in Section 055213 "Pipe and Tube Railings."

### B. Prime steel ships' ladders, including treads, railings, brackets, and fasteners, with zinc-rich primer. **Primer specified in Section 099600 "High-Performance Coatings."**

## 2.9 ELEVATOR PIT SUMP COVERS

- A. Fabricate from welded or pressure-locked steel bar grating Limit openings in gratings to no more than 1/2 inch (12 mm) in least dimension.
- B. Provide steel angle supports as indicated.

## 2.10 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. Prime exterior miscellaneous steel trim with zinc-rich primer. **Primer specified in Section 099600 "High-Performance Coatings."**

## 2.11 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 40 steel pipe.
  - 1. Where bollards are indicated to receive controls for door operators, provide cutouts for controls and holes for wire.
  - 2. Where bollards are indicated to receive light fixtures, provide cutouts for fixtures and holes for wire.
- B. Fabricate bollards with 3/8-inch- (9.5-mm-) thick steel baseplates for bolting to concrete slab. Drill baseplates at all four 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. Prime bollards with zinc-rich primer. **Primer specified in Section 099600 "High-Performance Coatings."**

## 2.12 DOWNSPOUT GUARDS

- A. Fabricate downspout guards from 3/8-inch- (9.5-mm-) thick 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 unless otherwise indicated.

- B. Prime downspout guards with zinc-rich primer. **Primer specified in Section 099600 "High-Performance Coatings."**

## 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 no fewer than two integrally welded steel strap anchors for embedding in concrete.

## 2.14 FINISHES, GENERAL

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

## 2.15 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
  - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
  - 1. Shop prime with universal shop primer unless primers specified in Section 099600 "High-Performance Coatings" are indicated.
- D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
  - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 4. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- E. Shop Priming: Apply shop primer to 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.

## 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 screws, 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.

### 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, overhead doors and overhead grilles** securely to, and rigidly brace from, building structure.

### 3.3 INSTALLING METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.

1. Do not fill removable bollards with concrete.
- B. Anchor bollards to existing construction with expansion anchors. 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.
- C. Anchor bollards in 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 grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch (3 mm) toward bollard.
- D. 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.
- E. Fill bollards solidly with concrete, mounding top surface to shed water.
  1. Do not fill removable bollards with concrete.

#### 3.4 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. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055000

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## SECTION 055113 - METAL PAN STAIRS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

1. Preassembled steel stairs with concrete-filled treads.
2. Steel tube railings attached to metal stairs.
3. Steel tube handrails attached to walls adjacent to metal stairs.
4. Railing gates at the level of exit discharge.

- B. Related Requirements:

1. Section 033000 "Cast-in-Place Concrete" for concrete fill for stair treads and platforms.
2. Section 055213 "Pipe and Tube Railings" for pipe and tube railings.

#### 1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal stairs. 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.
- C. Coordinate locations of hanger rods and struts with other work so that they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For metal pan stairs and the following:
  1. Prefilled metal-pan-stair treads.



2. Precast concrete treads.
  3. Epoxy-resin-filled stair treads.
  4. Nonslip aggregates and nonslip-aggregate finishes.
  5. Abrasive nosings.
  6. Paint products.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Delegated-Design Submittal: For stairs and railings, including analysis data and shop drawings signed and sealed by the qualified professional engineer, licensed in project state, responsible for their preparation.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work, but are not limited to, the following:
1. Alfab, Inc.
  2. American Stair, Inc.
  3. Lapeyre Stair Inc.
  4. Pacific Stair Corporation.
  5. Worthington Metal Fabricators.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stairs and railings.

- B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
1. Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
  2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
  3. Uniform and concentrated loads need not be assumed to act concurrently.
  4. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
  5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch (6.4 mm), whichever is less.
- C. Structural Performance of Railings: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
1. Handrails and Top Rails of Guards:
    - a. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
    - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
  2. Infill of Guards:
    - a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
    - b. Infill load and other loads need not be assumed to act concurrently.
- D. Seismic Performance of Stairs: Metal stairs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. Component Importance Factor: 1.5.

## 2.3 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- C. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- D. Steel Tubing: ASTM A 500 (cold formed).
- E. Uncoated, Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, either commercial steel, Type B, or structural steel, Grade 25 (Grade 170), unless another grade is required by design loads; exposed.

- F. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating, either commercial steel, Type B, or structural steel, Grade 33 (Grade 230), unless another grade is required by design loads.

## 2.4 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 12 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
- B. 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. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
  - 1. Provide mechanically deposited or hot-dip, zinc-coated anchor bolts for stairs indicated to be galvanized.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, 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/E 488M, conducted by a qualified independent testing agency.
  - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
  - 2. Material for Exterior Locations: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

## 2.5 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 099100 "Painting" and Section 099600 "High-Performance Coatings."
- B. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- D. Concrete Materials and Properties: Comply with requirements in Section 033000 "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.

- E. Nonslip-Aggregate Concrete Finish: Factory-packaged abrasive aggregate made from fused, aluminum-oxide grits or crushed emery; rustproof and non-glazing; unaffected by freezing, moisture, or cleaning materials.
- F. Welded Wire Reinforcement: ASTM A 185/A 185M, 6 by 6 inches (152 by 152 mm), W1.4 by W1.4, unless otherwise indicated.

## 2.6 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, railings, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
  - 1. Join components by welding unless otherwise indicated.
  - 2. Use connections that maintain structural value of joined pieces.
- B. Preassembled Stairs: Assemble stairs in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- C. 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.
- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections 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 to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 2 welds: completely sanded joint, some undercutting and pinholes are okay.
- G. 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.

## 2.7 STEEL-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with "Recommended Voluntary Minimum Standards for Fixed Metal Stairs" in NAAMM AMP 510, "Metal Stairs Manual," Commercial Class, unless more stringent requirements are indicated.

B. Stair Framing:

1. Fabricate stringers of steel channels.
  - a. Provide closures for exposed ends of channel stringers.
2. Construct platforms of steel channel headers and miscellaneous framing members as indicated.
3. Weld stringers to headers; weld framing members to stringers and headers.
4. Where stairs are enclosed by gypsum board assemblies, provide hanger rods or struts to support landings from floor construction above or below. Locate hanger rods and struts where they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.

C. Metal Pan Stairs: Form risers, subtread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.067 inch (1.7 mm).

1. Steel Sheet: Uncoated cold-rolled steel sheet.
2. Steel Sheet: Galvanized-steel sheet, where indicated.
3. Directly weld metal pans to stringers; locate welds on top of subtreads where they are concealed by concrete fill. Do not weld risers to stringers.
4. Attach risers and subtreads to stringers with brackets made of steel angles or bars. Weld brackets to stringers and attach metal pans to brackets by welding, riveting, or bolting.
5. Shape metal pans to include nosing integral with riser.
6. At Contractor's option, provide stair assemblies with metal pan subtreads filled with reinforced concrete during fabrication.

## 2.8 STAIR RAILINGS

A. Comply with applicable requirements in Section 055213 "Pipe and Tube Railings."

1. Rails may be bent at corners, rail returns, and wall returns, instead of using prefabricated fittings.
2. Connect posts to stair framing by direct welding unless otherwise indicated.

B. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 2 welds: completely sanded joint, some undercutting and pinholes are okay as shown in NAAMM AMP 521.

C. Form changes in direction of railings as follows:

1. By bending or by inserting prefabricated elbow fittings.

- D. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- E. Close exposed ends of railing members with prefabricated end fittings.
- F. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.
- G. Connect posts to stair framing by direct welding unless otherwise indicated.
- H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
  - 1. For galvanized railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous-metal components.
  - 2. For nongalvanized railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors embedded in exterior masonry and concrete construction.
  - 3. Provide type of bracket with predrilled hole for exposed bolt anchorage and that provides 2-1/4-inch clearance from inside face of handrail to finished wall surface.
- I. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

## 2.9 FINISHES

- A. Finish metal stairs after assembly.
- B. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
  - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
  - 2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- C. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
- D. Apply shop primer to uncoated surfaces of metal stair components, 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 INSTALLING METAL PAN STAIRS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs 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 metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. 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.
- F. Field Welding: Comply with requirements for welding in "Fabrication, General" Article.
- G. Place and finish concrete fill for treads and platforms to comply with Section 033000 "Cast-in-Place Concrete."

### 3.2 INSTALLING RAILINGS

- A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction as follows:
  - 1. Anchor posts to steel by welding to steel supporting members.
  - 2. Anchor handrail ends to concrete and masonry with steel round flanges welded to rail ends and anchored with post-installed anchors and bolts.
- B. Attach handrails to wall with wall brackets. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as follows:
  - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.

2. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.

### 3.3 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 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. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055113



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## SECTION 055213 - PIPE AND TUBE RAILINGS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section Includes:

- 1. Steel pipe and tube railings.

- B. Related Requirements:

- 1. Section 055112 "Metal Pan Stairs" for steel tube railings associated with metal pan stairs.
  - 2. Section 057300 "Decorative Metal Railings" for ornamental railings fabricated from pipes and tubes.

## 1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for railings. 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.
- C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

## 1.4 ACTION SUBMITTALS

- A. Product Data: For the following:

- 1. Manufacturer's product lines of mechanically connected railings.
  - 2. Railing brackets.
  - 3. Grout, anchoring cement, and paint products.

- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Delegated-Design Submittal: For railings, including analysis data and shop drawings signed and sealed by the qualified professional engineer, licensed in project state, responsible for their preparation.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Product Test Reports: For pipe and tube railings, for tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.
- D. Evaluation Reports: For post-installed anchors, from ICC-ES.

#### 1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

#### 1.8 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Steel Pipe and Tube Railings:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Wagner, R & B, Inc.

- B. Source Limitations: Obtain each type of railing from single source from single manufacturer.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Handrails and Top Rails of Guards:
    - a. Uniform load of 50 lbf/ ft. (0.73 kN/m) applied in any direction.
    - b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
  - 2. Infill of Guards:
    - a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
    - b. Infill load and other loads need not be assumed to act concurrently.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change: **120 deg F (67 deg C), ambient.**

## 2.3 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
  - 1. Provide type of bracket with predrilled hole for exposed bolt anchorage and that provides 2-1/4-inch clearance from inside face of handrail to finished wall surface.

## 2.4 STEEL AND IRON

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of pre-consumer recycled content not less than 25 percent.
- B. Tubing: ASTM A 500 (cold formed).

- C. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
  - 1. Provide galvanized finish for exterior installations and where indicated.
- D. Plates, Shapes, and Bars: ASTM A 36/A 36M.

## 2.5 FASTENERS

- A. General: Provide the following:
  - 1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5 for zinc coating.
  - 2. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Fasteners for Interconnecting Railing Components:
  - 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
  - 1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.
  - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1) stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, 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. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.

- D. Shop Primers: Provide primers that comply with Section 099100 "Painting" and Section 099600 "High-Performance Coatings."
- E. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- F. Intermediate Coats and Topcoats: Provide products that comply with Section 099100 "Painting" and Section 099600 "High-Performance Coatings."
- G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- H. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

## 2.7 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. 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.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
  - 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 flux immediately.

4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- I. Form Changes in Direction as Follows:
  1. By bending or by inserting prefabricated elbow fittings.
- J. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- K. Close exposed ends of railing members with prefabricated end fittings.
- L. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.
- M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
  1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- N. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- O. For removable railing posts, fabricate slip-fit sockets from steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.
  1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.

## 2.8 STEEL AND IRON FINISHES

- A. Galvanized Railings:
  1. Hot-dip galvanize indicated steel railings, including hardware, after fabrication.
  2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
  3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
  4. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

5. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
- D. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, galvanize anchors to be embedded in exterior concrete or masonry.
- E. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with requirements indicated below:
  1. Exterior Railings: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  2. Railings Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  3. Railings Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  4. Other Railings: SSPC-SP 3, "Power Tool Cleaning."
- F. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
  1. Shop prime uncoated railings with Section 099100 "Painting" unless primers specified in Section 099600 "High-Performance Coatings" are indicated.
  2. Do not apply primer to galvanized surfaces.
- G. Shop-Painted Finish: Comply with Section 099100 "Painting" unless Section 099600 "High-Performance Coatings" are indicated.
- H. High-Performance Coating: Apply epoxy intermediate and polyurethane topcoats to prime-coated surfaces. Comply with coating manufacturer's written instructions and with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Apply at spreading rates recommended by coating manufacturer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.



### 3.2 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
  - 1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
  - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
  - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3.5 m).
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
  - 1. Coat, with a heavy coat of bituminous paint, concealed surfaces of steel that are in contact with grout, concrete, masonry, wood, or dissimilar metals.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

### 3.3 RAILING CONNECTIONS

- A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.
- B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches (50 mm) beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches (150 mm) of post.

### 3.4 ANCHORING POSTS

- A. Form or core-drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Cover anchorage joint with flange of same metal as post, **welded to post after placing anchoring material.**

- C. Leave anchorage joint exposed with 1/8-inch (3-mm) buildup, sloped away from post.
- D. Anchor posts to steel by welding to steel support members.
- E. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

### 3.5 ATTACHING RAILINGS

- A. Anchor railing ends at walls with round flanges anchored to wall construction and welded to railing ends.
- B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends.
- C. Attach railings to wall with wall brackets, except where end flanges are used. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- D. Secure wall brackets and railing end flanges to building construction as follows:
  - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
  - 2. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.

### 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 the 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. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.

### 3.7 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION 055213

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## SECTION 061000 - ROUGH CARPENTRY

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

## A. Section Includes:

1. Rooftop equipment bases and support curbs.
2. Wood blocking and nailers.
3. Wood furring.
4. Utility shelving.
5. Plywood backing panels.

## B. Related Requirements:

1. Section 061643 "Gypsum Sheathing" for exterior sheathing.
2. Section 313116 "Termite Control" for site application of borate treatment to wood framing.

## 1.3 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal (38 mm actual) size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal (38 mm actual) or greater size but less than 5 inches nominal (114 mm actual) size in least dimension.

## 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
  1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
  2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

Include physical properties of treated materials based on testing by a qualified independent testing agency.

3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

## 1.5 INFORMATIONAL SUBMITTALS

### A. Evaluation Reports: For the following, from ICC-ES:

1. Preservative-treated wood.
2. Fire-retardant-treated wood.
3. Power-driven fasteners.
4. Post-installed anchors.
5. Metal framing anchors.

## 1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.
- B. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.
- C. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

## PART 2 - PRODUCTS

### 2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 19 percent unless otherwise indicated.

## 2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPAC U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, blocking, furring, and similar concealed members in contact with masonry or concrete.

## 2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Treatment shall not promote corrosion of metal fasteners.
  2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
  3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
- E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.
- F. Application: Treat items indicated on Drawings, and the following:
1. Framing for raised platforms.
  2. Concealed blocking.
  3. Roof framing and blocking.
  4. Wood nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.
  5. Plywood backing panels.

## 2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
1. Blocking.
  2. Nailers.
  3. Rooftop equipment bases and support curbs.
  4. Furring.
  5. Utility shelving.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species:
1. Mixed southern pine or southern pine; SPIB.
  2. Western woods; WCLIB or WWPA.
  3. Northern species; NLGA.
  4. Eastern softwoods; NeLMA.

- C. Utility Shelving: Lumber with 15 percent maximum moisture content of any of the following species and grades:
1. Eastern white pine, Idaho white, lodgepole, ponderosa, or sugar pine; Premium or No. 2 Common (Sterling) grade; NeLMA, NLGA, WCLIB, or WWPA.
  2. Mixed southern pine or southern pine No. 1 grade; SPIB.
  3. Hem-fir or hem-fir (north), Select Merchantable or No. 1 Common grade; NLGA, WCLIB, or WWPA.
  4. Spruce-pine-fir (south) or spruce-pine-fir, Select Merchantable or No. 1 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
- D. Concealed Boards: 15 percent maximum moisture content of any of the following species and grades:
1. Mixed southern pine or southern pine, No. 3 grade; SPIB.
  2. Eastern softwoods, No. 3 Common grade; NELMA.
  3. Northern species, No. 3 Common grade; NLGA.
  4. Western woods, Standard or No. 3 Common grade; WCLIB or WWPA.
- E. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- F. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- G. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

## 2.5 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch (19-mm) nominal thickness.

## 2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Screws for Fastening to Metal Framing: ASTM C 954, length as recommended by screw manufacturer for material being fastened.



- D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 as appropriate for the substrate.
  - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
  - 2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Grade A1 or A4).

## 2.7 METAL FRAMING ANCHORS

- A. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 (Z180) coating designation.
  - 1. Use for interior locations unless otherwise indicated.
- B. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 (Z550) coating designation; and not less than 0.036 inch (0.9 mm) thick.
  - 1. Use for wood-preservative-treated lumber and where indicated.

## 2.8 MISCELLANEOUS MATERIALS

- A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch (0.6 mm).

# PART 3 - EXECUTION

## 3.1 INSTALLATION, GENERAL

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.
- C. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

- D. Do not splice structural members between supports unless otherwise indicated.
- E. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
  - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches (406 mm) o.c.
- F. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
  - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches (2438 mm) o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
- G. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- H. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber per manufacturer's requirements.
  - 1. Use inorganic boron for items that are continuously protected from liquid water.
  - 2. Use copper naphthenate for items not continuously protected from liquid water.
- I. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- J. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. Table 2304.9.1 "Fastening Schedule," in ICC's 2012 International Building Code.
  - 2. ICC-ES evaluation report for fastener.
- K. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

### 3.2 WOOD BLOCKING AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

### 3.3 WOOD FURRING INSTALLATION

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

END OF SECTION 061053

## SECTION 061600 - SHEATHING

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section Includes:

- 1. Wall sheathing.
- 2. Parapet sheathing.
- 3. Sheathing joint and penetration treatment.

- B. Related Requirements:

- 1. Section 061000 "Rough Carpentry" for plywood backing panels.
- 2. Section 072500 "Weather Barriers" for water-resistive barrier applied over wall sheathing.

## 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
  - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
  - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
  - 3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5516.
  - 4. For products receiving waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

## 1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated plywood.
2. Fire-retardant-treated plywood.

## 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

# PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: As tested according to ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

## 2.2 WOOD PANEL PRODUCTS

- A. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.
- B. Factory mark panels to indicate compliance with applicable standard.

## 2.3 PRESERVATIVE-TREATED PLYWOOD

- A. Preservative Treatment by Pressure Process: AWPAC U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
  1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
- B. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

- C. Application: Treat all plywood unless otherwise indicated.

## 2.4 FIRE-RETARDANT-TREATED PLYWOOD

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.
  - 1. Use treatment that does not promote corrosion of metal fasteners.
  - 2. Type: Treated materials shall comply with requirements specified above for fire-retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
- C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.
- E. Application: Treat plywood indicated on Drawings, and the following:
  - 1. Roof and wall sheathing within 48 inches (1220 mm) of fire walls.
  - 2. Roof sheathing.

## 2.5 EXTERIOR WALL SHEATHING

- A. Plywood Sheathing: DOC PS 1, Exterior sheathing.
  - 1. Span Rating: Not less than 32/16.
  - 2. Nominal Thickness: Not less than 1/2 inch (13 mm).
- B. Glass-Mat Gypsum Sheathing: ASTM C 1177/1177M.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. CertainTeed Corporation; GlasRoc.
    - b. Georgia-Pacific Building Products; Dens-Glass Gold.
    - c. National Gypsum Company; Gold Bond eXP Extended Exposure Sheathing.
    - d. United States Gypsum Company; Securock.

2. Type and Thickness: Type X, 5/8 inch (15.9 mm) thick.
3. Size: 48 by 96 inches (1219 by 2438 mm) for vertical installation.

## 2.6 PARAPET SHEATHING

- A. As noted in Drawings.
- B. Plywood Sheathing: DOC PS 1, Exposure 1; AWWA U1, Use Category UCFB for exterior construction not in contact with ground.
  1. Span Rating: Not less than 32/16.
  2. Nominal Thickness: Not less than 1/2 inch (13 mm).
- C. Glass-Mat Gypsum Sheathing: ASTM C 1177/1177M.

## 2.7 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
  1. For roof, parapet, and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- C. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.
- D. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.
  1. For steel framing less than 0.0329 inch (0.835 mm) thick, use screws that comply with ASTM C 1002.
  2. For steel framing from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick, use screws that comply with ASTM C 954.

## 2.8 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C 834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
  1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches (50 mm) wide, 10 by 20 threads/inch (390 by 780 threads/m), of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in

sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
  - 1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
  - 2. ICC-ES evaluation report for fastener.
- D. Coordinate wall, parapet, and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

### 3.2 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
  - 1. Wall and Roof Sheathing:
    - a. Screw to cold-formed metal framing.
    - b. Space panels 1/8 inch (3 mm) apart at edges and ends.

### 3.3 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
  - 1. Fasten gypsum sheathing to cold-formed metal framing with screws.
  - 2. Install panels with a 3/8-inch (9.5-mm) gap where non-load-bearing construction abuts structural elements.



3. Install panels with a 1/4-inch (6.4-mm) gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.
- C. Horizontal Installation: Abut ends over centers of studs, and stagger end joints of adjacent panels not less than one stud spacing. Attach at perimeter and within field of panel to each stud.
  1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of panels.
- D. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.
  1. Space fasteners approximately 8 inches (200 mm) o.c. and set back a minimum of 3/8 inch (9.5 mm) from edges and ends of panels.
- E. Seal sheathing joints according to sheathing manufacturer's written instructions.
  1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.

END OF SECTION 061600

## SECTION 071616 - CRYSTALLINE WATERPROOFING

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section includes:
  - 1. Crystalline waterproofing.
- B. Related Sections include the following:
  - 1. Division 03 Section "Cast-in-Place Concrete" for formwork, waterstops, and finishing concrete walls and slabs to receive waterproofing.
  - 2. Division 07 Section "Joint Sealants" for elastomeric and preformed sealants in concrete and masonry walls and floors.

## 1.3 ACTION SUBMITTALS

- A. Product Data: Submit product data, including construction details, material descriptions, installation instructions, and general recommendations for crystalline waterproofing.

## 1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For crystalline waterproofing, signed by product manufacturer.
- B. Qualification Data: For Installer and manufacturer.
- C. Material Test Reports: For crystalline waterproofing, from independent testing laboratory, demonstrating that the waterproofing system complies with requirements of this Section.
- D. Manufacturer's inspection reports of completed installation.
- E. Warranty: Special warranty specified in this Section.

## 1.5 QUALITY ASSURANCE

### A. Manufacturer Qualifications:

1. ISO 9001 certified.
2. Having at least 10 years experience in the manufacture of cementitious crystalline waterproofing materials.

### B. Applicator Qualifications: Waterproofing applicator shall be experienced in the installation of cementitious crystalline waterproofing materials as demonstrated by previous successful installations, and shall be approved by the manufacturer in writing.

### C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to crystalline waterproofing including, but not limited to, the following:

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review required certifying procedures.

## 1.6 PROJECT CONDITIONS

### A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit crystalline waterproofing to be performed according to manufacturer's written instructions and warranty requirements.

### B. Proceed with waterproofing work only after pipe sleeves, vents, curbs, inserts, drains, and other projections through the substrate to be waterproofed have been completed. Proceed only after concrete and masonry substrate defects, including honeycombs, voids, and cracks, have been repaired to provide a sound substrate free of forming materials, including reveal inserts.

### C. Ambient Conditions: Proceed with waterproofing work only if temperature is maintained at 40 deg F (4.4 deg C) or above during work and cure period, and space is well ventilated and kept free of water.

## 1.7 WARRANTY

### A. Special Warranty: Warrant waterproofing Work from defects in materials and workmanship, including leakage, within specified warranty period.

1. Failures include, but are not limited to, the following:
  - a. Failure to maintain watertight conditions within specified warranty period.
2. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the following:

1. Crystalline Waterproofing:
  - a. Xypex Chemical Corporation; Xypex Concentrate.
  - b. Xypex Chemical Corporation; Xypex Modified.
2. Plugging and Patching for Leak Repair:
  - a. Xypex Chemical Corporation; Patch 'n Plug.
  - b. Xypex Chemical Corporation; Dry-Pac.

### 2.2 MATERIALS

- A. Crystalline Waterproofing: A prepackaged, proprietary blend of portland cement, specially treated sand, and active chemicals that, when mixed with water and applied, penetrates by capillary action into concrete or masonry and reacts chemically with free lime in the presence of water to develop crystalline growth within concrete or masonry capillaries to produce an impervious, dense, waterproof concrete or masonry.
- B. Patching Compound: Cementitious waterproofing and repair mortar for filling and patching tie holes, honeycombs, reveals, and other imperfections.
- C. Plugging Compound: Cementitious compound with hydrophobic properties; resistant to water and moisture but vapor permeable for all standard applications (vertical, overhead and horizontal surfaces not exposed to vehicular traffic).
- D. Water: Clean, potable, and free of alkali, acid, or deleterious materials.

### 2.3 MIXES

- A. General: Mix waterproofing material by volume with clean water. Mix waterproofing material in quantities that can be applied within 20-30 minutes from time of mixing. As mixture thickens, stir frequently, but do not add additional water. Do not mix bonding agents or admixtures with crystalline waterproofing materials.
- B. Brush Application Mix: Measure dry powder and place in mixing container. Measure water and mix into the dry powder with a paddle on a slow speed electric drill (250 RPM) or other type mixer which is acceptable to manufacturer. Mixing proportions shall be as follows:
  1. Proportions (by Volume):
    - a. 1.5 lb./sq. yd. – five parts powder to two parts water.
    - b. 2.0 lb./sq. yd. – three parts powder to one part water.

## C. Plugging and Patching:

1. Dry-Pac Mix: Using a trowel, mix one part clean water with six parts Xypex Concentrate powder for 10-15 seconds. It is acceptable that lumps may be present in mixture. Mix only as much as can be applied in 15 minutes.
2. Patch'n Plug Mix: Add one part water to 3.5 parts Patch'n Plug by volume and mix to the consistency of a stiff putty. Do not mix more than can be used in three minutes.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Acceptance of Conditions: Examine substrates, with Applicator and Manufacturer's Representative present, where waterproofing is to be applied.
1. Proceed with application only after unsatisfactory conditions have been corrected.
  2. Notify Architect in writing of active leaks or structural defects that would affect system performance.

## 3.2 PREPARATION

- A. Protect other work from damage from cleaning, preparation, and application of crystalline waterproofing. Provide temporary enclosure to confine spraying operation and to ensure adequate ambient temperatures and ventilation conditions for application.
- B. Stop active water leaks according to waterproofing manufacturer's written instructions.
- C. Repair damaged or unsatisfactory concrete or masonry according to manufacturer's written instructions.
1. Joints, coves, and other similar conditions
    - a. Apply a slurry coat of Xypex Concentrate. Allow slurry to reach an initial set, then fill cavity with Xypex Dry-Pac.
  2. Form tie holes, rock pockets, honeycombing, cracks, or other defective concrete
    - a. Apply Xypex Patch'n Plug. Allow to harden per manufacturer's instructions, then apply Xypex Dry-Pac followed a brush coat of Xypex Concrete.
- D. Surface Preparation: Comply with waterproofing manufacturer's written instructions to remove efflorescence, chalk, dust, dirt, mortar spatter, grease, oils, curing compounds, and form-release agents to ensure that waterproofing bonds to concrete or masonry surfaces.

1. Clean concrete surfaces according to ASTM D 4258.
  - a. Scratch- and Float-Finished Concrete: Etch with 10 percent muriatic (hydrochloric) acid solution according to ASTM D 4260 or pressure wash using 3,000 to 4,000 psi water stream.
  - b. Prepare smooth-formed and trowel-finished concrete by mechanical abrading or abrasive-blast cleaning according to ASTM D 4259.
  - c. Wood-Formed Vertical Concrete Surfaces: Pressure wash, lightly sandblast, or acid etch with muriatic (hydrochloric) acid to provide a clean, absorbent surface.
2. Concrete Joints: Clean reveals according to waterproofing manufacturer's written instructions.

### 3.3 APPLICATION

- A. General: Comply with waterproofing manufacturer's written instructions for application.
  1. Saturate concrete substrate with clean water to ensure migration of crystalline chemicals into voids and capillary tracts of concrete. Remove free surface water before application.
  2. Maintain damp condition until applying waterproofing.
  3. Number of Coats: Two for brush application.
    - a. After repairs, surface preparation, treatment of joints and sealing strip placement have been completed in accordance with manufacturer's written instructions and as specified herein, apply treatment uniformly to surfaces with semi-stiff bristle or broom. Application rates shall be as indicated and in accordance with manufacturer's written instructions. When brushing, work slurry well into surface, filling surface pores and hairline cracks.
      - 1) First Coat: Xypex Concentrate.
      - 2) Second Coat: Xypex Modified. Apply slurry coat while first coat is still "green", but after it has reached an initial set.
  4. Dampen surface between coats.
- B. Final Coat Finish: Brushed.
- C. Joints: Apply specified slurry at a rate of 2.0 lb./sq. yd. to joint surfaces between concrete pours. Moisten surfaces prior to slurry application. Where joints surfaces are not accessible prior to pouring new concrete, consult Manufacturer for application procedures.
- D. Sealing Strips, Coves, and Similar Conditions: Prepare surfaces that will come in contact with sealing strips and coves by applying one coat of specified slurry at a rate of 1.5 lb./sq. yd. Then fill with specified dry-packing material.
- E. Moist-cure waterproofing for two days immediately after application has set, followed by two days of air drying as recommended in writing by manufacturer.

F. Waterproofing Treatment Extensions: Extend waterproofing treatment as follows:

1. Onto columns integral with treated walls.
2. Onto interior nontreated walls intersecting exterior treated walls, for a distance of 24 inches (600 mm) for cast-in-place concrete and 48 inches (1200 mm) for masonry.
3. Onto exterior walls and onto both exterior and interior columns, for a height of 12 inches (300 mm), where floors, but not walls, are treated.
4. Onto every substrate in areas indicated for treatment, including pipe trenches, pipe chases, pits, sumps, and similar offsets and features.

3.4 PROTECTION

- A. Protect applied crystalline waterproofing from rapid drying, severe weather exposure, traffic and water accumulation. Maintain completed Work in moist condition for not less than two days by procedures recommended in writing by waterproofing manufacturer. Protect waterproofing from temperatures below 36 deg F (2 deg C). Take measures to protect completed crystalline waterproofing coating from damage for at least 2 weeks after application.

3.5 FIELD QUALITY CONTROL

- A. Inspection: Manufacturer's representative to inspect completed application and to provide a written report that application complies with manufacturer's written instructions.

END OF SECTION 071616

## SECTION 071700 - RETAINING WALL WATER-PROOFING

**PART 1 - GENERAL**

## 1.01 RELATED DOCUMENTS

- A. All of the Contract Documents, including General and Supplementary Conditions, and Division 1 General requirements, apply to the work of this section.

## 1.02 WORK SUMMARY

- A. The work of this section includes, but is not limited to the furnishing and installing the following materials, per project specifications and drawings, or as directed by bentonite waterproofing manufacturer:
  - 1. Bentonite composite waterproofing membrane with all applicable accessory products.
  - 2. Prefabricated drainage composite and Base Drain.

## 1.03 RELATED SECTIONS

- A. Other specification Sections which directly relate to the work of this section include, but are not limited to, the following:
  - 1. Division 2: Subsurface and Geotechnical Investigations
  - 2. Division 5: Expansion Joint Products
  - 3. Division 7: Joint Treatment/ Sealants, Flashing and sheet metal, and Insulation
  - 4. Division 31: Earthwork, Excavation and Backfill

## 1.04 SYSTEM DESCRIPTION

- A. Provide bentonite membrane waterproofing and prefabricated drainage composite system to prevent the passage of liquid water and install without defects, damage or failure. Waterproofing membrane shall be a 90-mil (2.3 mm) composite of a sodium bentonite compound integrally bonded to a geomembrane liner with a silicone release liner.

## 1.05 SUBMITTALS

- A. General: Prepare and submit specified submittals in accordance with "Conditions of the Contract" and Division 1 Submittals Sections.
- B. Product Data: Submit manufacturer's product data, with complete general and specific installation instructions, recommendations, and limitations.
- C. Product Samples: Submit representative samples of the following for approval:
  - 1. Composite bentonite membrane waterproofing
  - 2. Base Drain and Prefabricated drainage composite



- D. Waterproofing Material and Labor Warranty: At time of bid, submit a sample copy of the Manufacturer's Waterproofing warranty complete with all coverage's, limitations, and conditions.
- E. Material Certificates: Submit certificate(s) signed by manufacturer certifying materials comply with specified performance characteristics and physical requirements. Submit certification that waterproofing system and components, drainage and protection materials are supplied by a single-source manufacturer.
- F. Contractor Certificate: At time of bid, submit written certification that installer has current Approved Applicator status with waterproofing material manufacturer.

#### 1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Installing company should have at least three (3) years experience in work of the type required by this section, who can comply with manufacturer's warranty requirements, and who is an Approved Applicator as determined by waterproofing/drainage system manufacturer.
- B. Manufacturer Qualifications: Bentonite waterproofing and all accessory products shall be provided by a single manufacturer with a minimum of 30 years experience in the direct production and sales of bentonite waterproofing systems. Manufacturer shall be capable of providing field service representation during construction, approving an acceptable installer, and recommending appropriate installation methods for bentonite waterproofing and prefabricated drainage system.
- C. Pre-Installation Conference: A pre-installation conference shall be held prior to commencement of field installation to establish procedures to maintain required working conditions and to coordinate this work with related and adjacent work. Verify that final waterproofing and waterstop details comply with waterproofing manufacturer's current installation requirements and recommendations. Pre-con meeting attendees should include representatives for the owner, architect, inspection firm, general contractor, waterproofing contractor, concrete contractor, excavating/backfill contractor, and mechanical and electrical contractors if work penetrates the waterproofing.
- D. Materials: Obtain bentonite composite membrane waterproofing and prefabricated drainage materials from a single manufacturer to assure material compatibility.
- E. Independent Inspection: Owner shall make all arrangements and payments for an independent inspection service to monitor waterproofing material installation compliance with the project contract documents and manufacturer's published literature and site specific details. Independent Inspection Firm shall be an approved company participating with the waterproofing manufacturer's Certified Inspection Program. Inspection service shall produce reports and digital photographs documenting each inspection. Reports shall be made available to the Contractor, waterproofing installer, waterproofing material manufacturer, and Architect. Inspections should include substrate examination, beginning of waterproofing installation, periodic intervals, and final inspection prior to concrete or backfill placement against the waterproofing.
- F. Water Sample Test: Project site water sample supplied to manufacturer by waterproofing contractor to determine suitability of bentonite system to be utilized on the

project. Manufacturer shall conduct test free of charge. Contractor is responsible for collection and shipment of 64-fluid ounces (2 liters) of actual site water. Water should be shipped in uncontaminated, sealed plastic container to the water-proofing manufacturer. Also provide project name, city and state along with return address to forward test results.

#### 1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery and Handling: Deliver materials in factory sealed and labeled packaging. Sequence deliveries to avoid delays, while minimizing on-site storage. Handle and store following manufacturer's instructions, recommendations and material safety data sheets. Protect from construction operation related damage, as well as, damage from weather, excessive temperatures and prolonged sunlight. Remove damaged material from site and dispose of in accordance with applicable regulations.
- B. Storage: Do not double-stack pallets during shipping or storage. Protect waterproofing materials from moisture, excessive temperatures and sources of ignition. Provide cover, top and all sides, for materials stored on-site, allowing for adequate ventilation.

#### 1.08 PROJECT CONDITIONS

- A. Substrate Condition: Proceed with work only when substrate construction and preparation work is complete and in condition to receive waterproofing system. All plumbing, electrical, mechanical and structural items to be under or passing through the waterproofing shall be positively secured in their proper positions prior to waterproofing system installation. All expansion joint materials and deck drains installed prior to waterproofing system installation. Substrate preparation shall be per waterproofing manufacturer's guidelines.
- B. Weather Conditions: Perform work only when existing and forecasted weather conditions are within the guidelines established by the manufacturer of the waterproofing materials. Do not apply waterproofing materials into standing water or over ice.

#### 1.09 WARRANTY

- A. Warranty eligibility for the project must be validated by Manufacturer, confirming acceptance of the installation and independent inspection reports are in accordance with the manufacturer's quality assurance program requirements.
- B. **Waterproofing Material and Labor Warranty:** Upon substantial completion, the waterproofing materials manufacturer will provide to the project Owner, a written five (5) year non-prorated warranty, covering both materials and labor.. Issuance of Manufacturer's Waterproofing Warranty requires the following:
  - 1. Waterproofing System products and drainage composite products shall have been provided by a single manufacturer.
  - 2. Installation of waterproofing products and prefabricated drainage composite by Manufacturer's Approved Applicator in full accordance with manufacturer's quality assurance program requirements,
  - 3. Installation inspected by an approved and trained Independent Inspection Firm participating with the waterproofing manufacturer's Certified Inspection Program

4. In Division 3 work, Waterstop-RX must be installed in all applicable concrete cold pour construction joints, including around applicable penetrations. Manufacturer's warranty shall be independent from any other warranties made by the Contractor under requirements of the Contract Documents and may run concurrent with the other warranties.

## PART 2 - PRODUCTS

### 2.01 MANUFACTURER

- A. Basis of Design: Swelltite bentonite composite membrane waterproofing with applicable accessories as manufactured by Colloid Environmental Technologies Company (CETCO), 2870 Forbs Ave., Hoffman Estates, IL 60192; Toll Free: 1-(800)-527-9948; 1-(847)851-1800. Web-site: <http://www.cetco.com>.

### 2.02 MATERIALS

- A. Sodium Bentonite Compound: Select sodium bentonite and butyl rubber blended to produce a uniform waterproofing compound integrally bonded to a geomembrane liner.

#### B. SWELLTITE COMPOSITE BENTONITE WATERPROOFING

1. Swelltite: 40" x 37' 9"x 90 mil thick composite waterproofing membrane consisting of 78-mil sodium bentonite/butyl rubber compound integrally bonded to 12-mil geomembrane liner with a clear siliconized release liner. Square Area of roll: 125 square feet (11.5 sq m). Typical membrane performance properties:

PROPERTY	TEST METHOD	TYPICAL VALUE
Hydrostatic Pressure Resistance	ASTM D 5385 mod.	231 ft. (70 m)
Permeability	ASTM D 5084	$1 \times 10^{-10}$ cm/sec.
Tensile Strength	ASTM D 412	1,940 psi
Puncture Resistance	ASTM E 154	300 lbs.
Low Temperature Flexibility	ASTM C 836	Unaffected
Decay Resistance	ASTM E 154	Unaffected
Elongation	ASTM D 412	25%
Water Vapor Transmission	ASTM E 96	0.01 grains/hr/ft <sup>2</sup>

- C. ACCESSORY WATERPROOFING PRODUCTS: All accessory waterproofing materials shall be provided by the bentonite waterproofing manufacturer or shall have manufacturer's written approval for substitution.

1. Bentoseal®: Trowel grade compound used as a detailing mastic for foundation wall applications.
2. Hydrobar Tubes: 2" (50 mm) diameter x 2' (60 cm) long, water soluble tube container filled with granular sodium bentonite
3. Waterstoppage®: 50 lbs. (22.7 kg) bag of active granular sodium bentonite.
4. SeamTape®: 2" (50 mm) wide butyl rubber sealant tape.

5. Termination Bar: Min. 1" (25 mm) wide aluminum bar with pre-punched holes on maximum 12" (300 mm) centering for fastening.
6. M-2000 Liquid Flashing: Trowel grade high solids content, modified polyurethane waterproofing detailing mastic for plaza deck applications.
7. A-3000WB Adhesive: Water-based latex adhesive applied to substrates to promote adhesion of Swelltite Membrane. Typical application rate 250—275 sq ft/gallon (25 sq m).
8. CETSEAL: single-component polyether general sealant and adhesive
9. GF-40SA: self-adhering flashing membrane used for grade and thru-wall flashing

#### D. BASE AND SHEET DRAINAGE COMPOSITE

Aquadrain® drainage composite by CETCO shall be used where specified to promote positive drainage. Use Aquadrain 15XP and 100BD base drain with accessory connectors and outlets as required for foundation walls. Use Aquadrain 20H or Aquadrain 30H for split-slab construction.

1. Aquadrain® 15XP - 4-ft by 52-ft roll of a three-dimensional polypropylene drainage core with a nonwoven geotextile adhered to one side to allow water passage while restricting soil particles. Composite includes a thin polyethylene sheet on the back of the drainage core.
  - A. Compressive Strength, 15,000psf (718kPa);
  - B. Flow Rate, 20gpm/ft (251 l/m/m);
  - C. Thickness, 7/16" (11 mm)
2. Aquadrain® 100BD Base Drain – 1" (25 mm) thick x 12" (300 mm) high base drain composite designed to collect water from sheet composite drainage and then discharge the water to proper sump system or gravity to daylight.
  - A. Compressive Strength, 10,000psf (457 kPa);
  - B. Water Flow rate, 97gpm/ft (1,197 l/m/m);
  - C. Thickness, 1" (25 mm)

### PART 3 – EXECUTION

- A. Comply with contract documents and manufacturer's product data, including product application and installation instructions.

#### 3.01 SUBSTRATE INSPECTION AND CONDITIONS

- A. The installer, with the Owner's Independent Inspector present, shall examine conditions of substrates and other conditions under which this section work is to be performed and notify the contractor, in writing, of circumstances detrimental to the proper completion of the work. Do not proceed with work until unsatisfactory conditions are corrected and are acceptable for compliance with manufacturer's warranty requirements. General substrate conditions acceptable for the waterproofing installation are listed below. For conditions not covered in this Section, contact the waterproofing manufacturer for guidance.
- B. CONCRETE: Cast-in-place concrete to receive waterproofing shall be of reinforced structural grade with a smooth finish, free of debris, oil, grease, laitance, dirt, dust, or other foreign matter which will impair the performance of the waterproofing and drainage system and which do not comply with manufacturer's warranty requirements. Swelltite

can be installed on green structural concrete as soon as the forms are removed. There is no product limitation regarding a minimum concrete curing time requirement for Swelltite to be installed over structural concrete. Manufacturer recommends gaining instructions from project structural engineer regarding any site specific concrete curing time requirement. Do not apply Swelltite waterproofing over lightweight insulating concrete. If substrate is precast concrete, consult waterproofing manufacturer for special installation guides.

1. Remove dirt, debris, oil, grease, cement laitance, or other foreign matter which will impair or negatively affect the performance of the waterproofing and drainage system.
2. Protect adjacent work areas and finished surfaces from damage or contamination from waterproofing products during installation operations.
3. Form fins, ridges, ponding ridges and other protrusions should be level and smooth with concrete surface.
4. Honeycombing, aggregate pockets, tie-rod holes and other voids shall be completely filled with non-shrink cementitious grout and level with monolithic concrete surface.
5. Horizontal deck or roof concrete surfaces should be sloped for positive drainage to the deck drains or the perimeter edges. Deck drain positions should be designed with an appropriate sump depression surrounding the drain.
6. Precast concrete deck units shall be installed and secured to structural supports in accordance with the concrete panel manufacturer's requirements and industry practice. All joints between precast units shall be completely grouted and flush with deck. Any differential in elevation between precast units shall be feathered for a smooth transition.
7. All expansion joints should receive applicable expansion joint sealant product manufactured by others prior to the installation of the Swelltite Waterproofing System. Expansion joint material is the primary seal at the expansion joint and the expansion joint material manufacturer is responsible for water tightness of the joint.

NOTE: Related work to be completed under Division 3. Waterstop-RX shall be installed in all applicable vertical and horizontal concrete construction cold pour joints and around applicable penetrations, structural members, and tie-rod form holes that extend through the wall. Refer to Waterstop-RX Product Manual for further installation procedures and guidelines.

- C. **MASONRY BLOCK:** Masonry Cementitious Block Walls to receive waterproofing shall be of sound construction. Block surface shall be free of debris, oil, grease, laitance, dirt, or other foreign matter which will impair the performance of the waterproofing and drainage system and which do not comply with manufacturer's warranty requirements.

1. Masonry block must have a smooth exterior surface. Do not use Swelltite with Architectural textured or irregular surface block that does not provide a smooth surface.
2. All vertical and horizontal mortar joints must be struck flush with smooth exterior surface of masonry block.
3. All expansion joints should receive applicable expansion joint sealant product manufactured by others prior to the installation of the Swelltite Waterproofing System.

Expansion joint material is the primary seal at the expansion joint and the expansion joint material manufacturer is responsible for water tightness of the joint.

NOTE: Related work to be completed under Division 3. Waterstop-RX shall be installed in all applicable vertical and horizontal concrete construction cold pour joints, around applicable penetrations and structural members, and tie-rod form holes that extend through the wall. Refer to Waterstop-RX Product Manual for further installation procedures and guidelines.

### 3.02 SURFACE PREPARATION

- A. Remove dirt, debris, oil, grease, cement laitance, or other foreign matter which will impair or negatively affect the performance of the waterproofing and drainage system.
- B. Protect adjacent work areas and finish surfaces from damage or contamination from waterproofing products during installation operations.
- C. Concrete surfaces to receive M-2000 Liquid Flashing should be water-cured and in place a minimum of seven (7) days prior to application. Allow wet concrete to thoroughly dry prior to applying M-2000 Liquid Flashing or Swelltite Membrane. M-2000 is compatible with clear, resin based curing compounds containing no oil, wax, or pigment.

### 3.03 GENERAL INSTALLATION GUIDELINES

- A. REMOVE CLEAR SILICONIZED RELEASE LINER FROM BACK OF SWELLTITE MEMBRANE PRIOR TO INSTALLATION. After removing the clear release liner, install Swelltite Waterproofing Membrane with the sodium bentonite compound side directly against the substrate surface to be waterproofed (white geomembrane side up facing installer) for both horizontal and vertical applications.
- B. Prevent bentonite waterproofing products from hydrating before material is contained with overburden or backfill. When threat of rain is imminent, installed bentonite products not already contained by overburden or backfill should have all seams sealed with Seamtape. After rain, promptly remove any standing water off membrane installation.
- C. Expansion Joints: Swelltite waterproofing is not an expansion joint filler or sealant, but may be used as an expansion joint cover over properly installed expansion joint assembly placed during substrate preparation. To use Swelltite as an expansion joint cover, trowel 1/8" (0.3 cm) thick, 6" (15 cm) wide layer of Bentoseal centered over expansion joint. Install a 24" (60 cm) wide strip of Swelltite centered over the expansion joint. Then place the main course of Swelltite.

### 3.04 BACKFILLED FOUNDATION WALLS

- A. Prior to membrane, Install a continuous 3/4" (18 mm) cant of Bentoseal at footing/wall joint.
- B. Inside Corners: Install a 3/4" (18 mm) thick continuous cant of Bentoseal at all vertical inside wall corners prior to installing membrane.

- C. Penetrations: For all pipe, rebar, structural and other penetrations install waterproofing system in accordance with manufacturer's detail for specific project condition(s).
  - D. Remove the clear release film from back of membrane before installation. Starting at the base of the wall, install the membrane horizontally oriented with the bottom edge extending over the Bentoseal cant and onto the footing a minimum of 6" (150 mm). Overlap all membrane edges a minimum of 2" (50 mm). Secure membrane edges with washer-head fasteners maximum 24" (600 mm) on center or less as required to contour surface. Apply 2" (50 mm) Bentoseal or M-2000 flashing centered along fastened membrane edge on the footing. Stagger membrane roll end seams a minimum 12" (300 mm). After base membrane course, Swelltite membrane may be installed horizontally or vertically oriented.
  - D2. (Optional Adhesive Method) Apply A-3000WB Adhesive by roller or spray at a rate of 250-275 sq ft/gallon (25 sq m) and allow to dry (cure) black. Remove the clear release film from back of membrane before installation. Starting at the base of the wall, install the membrane horizontally oriented with the bottom edge extending over the Bentoseal cant and onto the footing a minimum of 6" (150 mm). Overlap all membrane edges a minimum of 2" (50 mm). Stagger membrane roll end seams a minimum 12" (300 mm). Apply 2" (50 mm) Bentoseal or M-2000 flashing centered along fastened membrane edge on the footing. After the base course, Swelltite membrane may be installed horizontally or vertically oriented.
- NOTE:** If hydrostatic conditions exist, extend Swelltite membrane over entire footing to overlap the underslab waterproofing a minimum 6" (150 mm) to form a continuous waterproofing system. Install Seamtape along bottom membrane overlap edge.
- E. Seal all membrane overlap seam edges with Seamtape.
  - F. Terminate Swelltite membrane 12" (300 mm) below finished grade elevation secured with washer-head fasteners maximum 12" (300 mm) on center to exterior surface of concrete wall. Per manufacturer's detail for specific project condition(s), install GS-40SA grade flashing to primed concrete substrate with bottom edge overlapping top edge of Swelltite membrane minimum 4" (100 mm). Overlap all roll ends a minimum 4" (100 mm) to form a continuous flashing. Height of flashing shall be per project details and specifications. Install a rigid termination bar along the top edge of GF-40SA; fastened maximum 12" (300 mm) on center. Complete grade termination detail with tooled bead of CETSEAL along the top edge, at all penetrations through the flashing, and all exposed overlap seams.

G. Inspect installation and repair any damaged materials.

### 3.05 SUB-SURFACE DRAINAGE COMPOSITE DECK INSTALLATION

- A. At the base of the wall, place Aquadrain 100BD (100BD) base-drain horizontally oriented with the open core side up and the 2" (50 mm) flap of fabric side tight against the wall over the previously installed Swelltite membrane using wash-head mechanical fasteners or general construction adhesive. The 2" fabric flap along the top edge of 100BD should be tightly secured against the wall. Use 100BD accessory couplers and corner fittings, as

required, to form a continuous installation. Install 100BD discharge outlet fittings to connect to discharge pipes as required for the project.

- B. Install the bottom course of Aquadrain 15XP sheet drainage (plastic core side against the wall) with the 15XP bottom core edge in contact with open top core edge of 100BD. Secure sheet drain to wall with washer-head fasteners. Secure extra fabric flap of 15XP extending down the top front edge of 100BD to prevent the passage of soil into the core at the connection.
- C. Install subsequent courses of Aquadrain 15XP sheet drainage to within 12" (300 mm) of finished grade or as shown on the project drawings. Tightly abut adjoining sheet drain core edges together and secure the extra fabric flaps over the front of adjacent roll edges to prevent soil from entering the sheet drain. Secure sheet drain to wall with washer-head fasteners. Where drainage sheet panels are installed overlapped, bottom edge of higher course shall be installed to the outside of the lower course to shed water like a roof shingle.
- D. Around penetrations and tie-back heads, cut sheet drainage composite to fit and wrap extra filter fabric around open core edge to prevent soil from entering core.
- E. At the top of the sheet drain installation, wrap the filter fabric flap behind the exposed top core edge to prevent intrusion of soil into the core and secure sheet drain to wall with termination bar fastened 12" (300 mm) on center.

### 3.06 BACKFILL COVER

- A. Backfill shall be placed and compacted to minimum 85% Modified Proctor density promptly after waterproofing has been installed. Closely coordinate with contractor responsible for Backfill work by informing them each time a waterproofed area is ready for backfill. Backfill shall consist of compactable soil or angular aggregate (3/4" or less) free of debris, sharp objects, and stones larger than 3/4" (18 mm). Care should be used during backfill operation to avoid damage to the waterproofing system. If damage occurs, cease backfilling and report damage. Damaged waterproofing must be repaired per manufacturer's guidelines.

### 3.10 CLEAN UP

- A. Clean areas where adjacent finished surfaces are soiled by work of this Section, consult manufacturer of surfaces for cleaning advice and conform to their recommendations and instructions. Remove all tools, equipment and remaining product on-site. Dispose of section work debris and damaged product following all applicable regulations.

End of Section 071700



## SECTION 072100 - THERMAL INSULATION

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section Includes:
  - 1. Extruded polystyrene foam-plastic board.
  - 2. Glass-fiber blanket.
  - 3. Mineral-wool blanket.
  - 4. Mineral-wool board.
- B. Related Requirements:
  - 1. SECTION 072114 - SPRAY-FOAM INSULATION

## 1.3 ACTION SUBMITTALS

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

## 1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- B. Evaluation Reports: For foam-plastic insulation, from ICC-ES.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
  - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.

2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

## PART 2 - PRODUCTS

### 2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD

- A. Extruded Polystyrene Board, Type IV: ASTM C 578, Type IV, 25-psi (173-kPa) minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
- B. Products: Subject to compliance with requirements, provide one of the following:
  1. Dow Chemical Company (The); STYROFOAM Brand CAVITYMATE Plus Insulation.
  2. Owens Corning; FOAMULAR 250.

### 2.2 GLASS-FIBER BLANKET

- A. Glass-Fiber Blanket, Unfaced: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
- B. Products: Subject to compliance with requirements, provide one of the following:
  1. CertainTeed Corporation; CertaPro AcoustaTherm Batts.
  2. Guardian Building Products, Inc.; Unfaced Batts.
  3. Johns Manville; a Berkshire Hathaway company; Unfaced Batts; JM Formaldehyde-Free Fiber Glass Insulation.
  4. Knauf Insulation; Unfaced EcoBatt Insulation with ECOSE Technology.
  5. Owens Corning; EcoTouch PINK FIBERGLAS Insulation.

### 2.3 MINERAL-WOOL BLANKETS

- A. Mineral-Wool Blanket, Unfaced: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
- B. Products: Subject to compliance with requirements, provide one of the following:
  1. Johns Manville; a Berkshire Hathaway company; MinWool Sound Attenuation Fire Batts.
  2. Roxul Inc; COMFORTBATT.
  3. Thermafiber, Inc.; an Owens Corning company; FS-15.

- C. Mineral-Wool Blanket, Reinforced-Foil Faced: ASTM C 665, Type III (reflective faced), Class A (faced surface with a flame-spread index of 25 or less per ASTM E 84); Category 1 (membrane is a vapor barrier), faced with foil scrim, foil-scrim kraft, or foil-scrim polyethylene.
- D. Products: Subject to compliance with requirements, provide the following:
  - 1. Thermafiber, Inc.; an Owens Corning company; FS-25.

## 2.4 MINERAL-WOOL BOARD

- A. Mineral-Wool Board, Faced: ASTM C 612, Types IA and IB; faced on one side with foil-scrim or foil-scrim-polyethylene vapor retarder; with maximum flame-spread and smoke-developed indexes of 15 and zero, respectively, per ASTM E 84. Nominal density of 4 lb/cu. ft. (64 kg/cu. m).
- B. Products: Subject to compliance with requirements, provide one of the following:
  - 1. Industrial Insulation Group, LLC (IIG-LLC); MinWool-1200 Industrial Board
  - 2. Thermafiber, Inc.; an Owens Corning company; FireSpan 40.

## 2.5 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
- B. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
  - 1. AGM Industries, Inc; Series T TACTOO Insul-Hangers.
  - 2. Gemco; Spindle Type.
- C. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
- D. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Gemco; 90-Degree Insulation Hangers.
- E. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches (38 mm) square or in diameter.
- F. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:

1. AGM Industries, Inc; RC150 or SC150.
  2. Gemco; R-150 or S-150.
    - a. Perimeter walls where insulation is not installed within metal stud framing.
    - b. Ceiling plenums.
- G. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.
- H. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to the following:
1. AGM Industries, Inc; TACTOO Adhesive.
  2. Gemco; Tuff Bond Hanger Adhesive.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

#### 3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

#### 3.3 INSTALLATION OF CAVITY-WALL INSULATION

- A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 16 inches (406 mm) o.c. both ways on inside face and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.

### 3.4 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
  2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
  3. Maintain 3-inch (76-mm) clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
  4. For metal-framed wall cavities where cavity heights exceed 96 inches (2438 mm), support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
  5. Install 20 mil vapor barrier over blanket insulation, where noted in drawings.

### 3.5 INSTALLATION OF CURTAIN-WALL INSULATION

- A. Install board insulation in curtain-wall construction according to curtain-wall manufacturer's written instructions.
1. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated on Drawings between insulation and glass.
  2. Install insulation to fit snugly without bowing.

### 3.6 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

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## SECTION 072114 - SPRAY-FOAM INSULATION

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Closed Cell Spray Foam Insulation.

## 1.2 RELATED SECTIONS

- A. SECTION 072100 - THERMAL INSULATION.

## 1.3 REFERENCES

- A. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. ASTM D 1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics.
- C. ASTM D 1623 - Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
- D. ASTM D 2126 - Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
- E. ASTM C 518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

## 1.4 PERFORMANCE REQUIREMENTS

- A. Conform to applicable code for flame and smoke, concealment, and over coat requirements.

## 1.5 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
- B. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

## 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer with a minimum of ten years experience manufacturing products in this section shall provide all products listed.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging bearing

the brand name and manufacturer's identification until ready for installation.

- B. Storage: Store materials in dry locations with adequate ventilation, protected from freezing rain, direct sunlight and excess heat and in such a manner to permit easy access for inspection and handling. Store at temperature between 55 and 80 degrees F (12.7 to 26.6 degrees C).
- C. Handling: Handle materials to avoid damage.

## 1.8 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Do not apply insulation when substrate temperatures are under 40 degrees F (4.4 degrees C) prior to installation.
- C. Surfaces must be dry prior to application of spray foam. Excess humidity may cause poor adhesion, and result in product failure.
- D. To avoid overspray, product should not be applied when conditions are windy.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturer:
  - a. CertainTeed Corp., Insulation Group.
  - b. Dow-Corning
  - c. Tiger-Foam Insulation
  - d. Handi-Foam

### 2.2 SPRAY FOAM INSULATION

- A. Insulation: HFC-blown type Closed Cell Foam: medium-density, MDI-based polyurethane thermoset rigid foam:
  - 1. Physical and Mechanical Properties:
    - a. Core Density: 1.7-2.4 pcf when tested in accordance with ASTM D 1622.
    - b. Thermal Resistance (aged): 5.8 when tested in accordance with ASTM C 518 at 75 degrees F, (h-ft<sup>2</sup>- degrees F)/Btu.
    - c. Closed Cell Content: 88-90 percent when tested in accordance with ASTM D 2856.
  - 2. Fire performance
    - a. Flame Spread: Less than 25 when tested in accordance with ASTM E 84.



- b. Smoke: Less than 450 when tested in accordance with ASTM E 84.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Verify that all exterior and interior wall, partition, and floor/ceiling assembly construction has been completed to the point where the insulation may correctly be installed.
- C. Verify that substrate and cavities are dry and free of any foreign material that will impede application.
- D. Verify that mechanical and electrical services in ceilings, walls and floors have been installed and tested and, if appropriate, verify that adjacent materials are dry and ready to receive insulation.
- E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### 3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Mask and protect adjacent surfaces from overspray or dusting.

### 3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions. Product must be installed according to local code, and must be applied by a qualified applicator.
- B. Apply insulation by spray method, to uniform monolithic density without voids.
- C. Apply to achieve thermal resistance R-Value of 19, except where limited by steel members in-place.
- D. Apply insulation to seal voids at truss ends.
- E. Apply insulation to fill voids around doors and windows. Apply insulation to fill voids around accessible service and equipment penetrations.
- F. Do not install spray foam insulation in areas where it will be in contact with equipment or materials with operating temperatures of 180 degrees F (82 degrees C) or greater.
- G. Where building is designed to meet the specific air tightness standards of the Energy Star Program, apply insulation as recommended by manufacturer to

provide airtight construction.

H. Patch damaged areas.

### 3.4 PROTECTION

A. Protect installed products until completion of project.

END OF SECTION 072114

## SECTION 072419 - WATER-DRAINAGE EXTERIOR INSULATION AND FINISH SYSTEM (EIFS)

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. EIFS-clad drainage-wall assemblies that are field applied over substrate.
  - 2. Water-resistive coatings.
- B. Related Requirements:
  - 1. Section 079200 "Joint Sealants" for sealing joints in EIFS with elastomeric joint sealants and for perimeter joints between system and other materials.

#### 1.3 DEFINITIONS

- A. Definitions in ASTM E 2110 apply to Work of this Section.
- B. EIFS: Exterior insulation and finish system(s).
- C. IBC: International Building Code.

#### 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each EIFS component, trim, and accessory, including water-resistive coatings.
- B. Sustainable Design Submittals:
  - 1. Product Data: For adhesives, indicating VOC content.
  - 2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

3. Product Data: For coatings, indicating VOC content.
  4. Laboratory Test Reports: For coatings, indicating compliance with requirements for low-emitting materials.
- C. Samples for Initial Selection: For each type of finish-coat color and texture indicated.
1. Include similar Samples of exposed accessories involving color selection.
- D. Samples for Verification: 12-inch- (300-mm-) square panels for each type of finish-coat color and texture indicated, prepared using same tools and techniques intended for actual work including custom trim, each profile, and an aesthetic reveal.
1. Include exposed trim and accessory Samples to verify color selected.
  2. Include a typical control joint filled with sealant of color selected, as specified in Section 079200 "Joint Sealants."

## 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Manufacturer Certificates: Signed by EIFS manufacturer certifying the following:
1. EIFS complies with requirements.
  2. Substrates to which EIFS is indicated to be attached are acceptable to EIFS manufacturer.
  3. Accessory products installed with EIFS, including joint sealants, flashing, water-resistive coatings, trim, whether or not furnished by EIFS manufacturer and whether or not specified in this Section, are acceptable to EIFS manufacturer.
- C. Product Test Reports: For each EIFS assembly and component, and for water-resistive coatings, for tests performed by a qualified testing agency.
- D. Field quality-control reports and special inspection reports.
- E. Evaluation Reports: For EIFS, including insulation water-resistive coatings, flexible membrane flashing, from ICC-ES.
- F. Sample Warranty: For manufacturer's special warranty.

## 1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For EIFS to include in maintenance manuals.

## 1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An installer who is certified in writing by EIFS manufacturer as qualified to install manufacturer's system using trained workers.

- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, to set quality standards for materials and execution, and to set quality standards for fabrication and installation.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original, unopened packages with manufacturers' labels intact and clearly identifying products.
- B. Store materials inside and under cover; keep them dry and protected from weather, direct sunlight, surface contamination, aging, corrosion, damaging temperatures, construction traffic, and other causes.
  - 1. Stack insulation board flat and off the ground.
  - 2. Protect plastic insulation against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
  - 3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

#### 1.10 FIELD CONDITIONS

- A. Weather Limitations: Maintain ambient temperatures above 40 deg F (4.4 deg C) for a minimum of 24 hours before, during, and after adhesives or coatings are applied. Do not apply EIFS adhesives or coatings during rainfall. Proceed with installation only when existing and forecasted weather conditions and ambient outdoor air, humidity, and substrate temperatures permit EIFS to be applied, dried, and cured according to manufacturers' written instructions and warranty requirements.

#### 1.11 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of EIFS-clad drainage-wall assemblies that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Bond integrity and weathertightness.
    - b. Deterioration of EIFS finishes and other EIFS materials beyond normal weathering.
  - 2. Warranty coverage includes the following components of EIFS-clad drainage-wall assemblies:
    - a. EIFS finish, including base coats, finish coats, and reinforcing mesh.
    - b. Insulation installed as part of EIFS including foam build-outs.
    - c. Insulation adhesive.
    - d. EIFS accessories, including trim components and flashing.
    - e. Water-resistive coatings.

- f. EIFS drainage components.
- 3. Warranty Period: Minimum 15 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the following:
  - 1. Dryvit Systems, Inc.; Outsulation Plus MD System.
  - 2. Parex USA, Inc.; Optimum Water Master.
  - 3. Sto Corp; StoTherm ci Lotusan.
- B. Source Limitations: Obtain EIFS from single source, from single EIFS manufacturer and from sources approved by EIFS manufacturer as compatible with EIFS components.

### 2.2 PERFORMANCE REQUIREMENTS

- A. EIFS Performance: Comply with ASTM E 2568 and ICC-ES AC219 and with the following:
  - 1. Weathertightness: Resistant to uncontrolled water penetration from exterior, with a means to drain water entering EIFS to the exterior.
  - 2. Structural Performance: EIFS assembly and components shall comply with ICC-ES AC219 when tested according to ASTM E 2568.
    - a. Wind Loads: Uniform pressure as indicated on Drawings.
  - 3. Impact Performance: ASTM E 2568, Standard impact resistance unless otherwise indicated.
  - 4. Bond Integrity: Free from bond failure within EIFS components or between EIFS and substrates, resulting from exposure to fire, wind loads, weather, or other in-service conditions.
  - 5. Abrasion Resistance of Finish Coat: Sample consisting of 1-inch- (25.4-mm-) thick EIFS mounted on 1/2-inch- (12.7-mm-) thick gypsum board; cured for a minimum of 28 days and shows no cracking, checking, or loss of film integrity after exposure to 528 quarts (500 L) of sand when tested according to ASTM D 968, Method A.
  - 6. Mildew Resistance of Finish Coat: Sample applied to 2-by-2-inch (50.8-by-50.8-mm) clean glass substrate; cured for 28 days and shows no growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274.

## 2.3 EIFS MATERIALS

- A. Primer/Sealer: EIFS manufacturer's standard substrate conditioner designed to protect substrates from moisture penetration and to improve the bond between substrate and insulation adhesive.
  - 1. VOC Content: **250** g/L or less.
  - 2. Low-Emitting Materials: Coatings shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Water-Resistive Coatings: EIFS manufacturer's standard formulation and accessories for use as water-resistive barriers; compatible with substrate and complying with physical and performance criteria of ASTM E 2570.
  - 1. VOC Content: **250** g/L or less.
  - 2. Low-Emitting Materials: Coatings shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Flexible-Membrane Flashing: Cold-applied, self-adhering, self-healing, rubberized-asphalt and polyethylene-film composite sheet or tape and primer; EIFS manufacturer's standard or product recommended in writing by EIFS manufacturer.
- D. Insulation Adhesive: EIFS manufacturer's standard formulation designed for indicated use; specifically formulated to be applied to back side of insulation in a manner that creates open vertical channels designed to serve as an integral part of the water-drainage system of the EIFS-clad drainage-wall assembly; compatible with substrate; and complying with the following:
  - 1. Factory-blended dry formulation of portland cement, dry polymer admixture, and fillers specified for base coat.
  - 2. Adhesives shall have a VOC content of **50** g/L or less.
  - 3. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- E. Molded, Rigid Cellular Polystyrene Board Insulation: Comply with ASTM C 578, Type I; and EIFS manufacturer's requirements for most stringent requirements for material performance and qualities of insulation, including dimensions and permissible variations, and the following:
  - 1. Aging: Before cutting and shipping, age insulation in block form by air drying for not less than six weeks.
  - 2. Flame-Spread and Smoke-Developed Indexes: 25 and 450 or less, respectively, according to ASTM E 84.

3. Dimensions: Provide insulation boards of not more than 24 by 48 inches (610 by 1219 mm) and in thickness indicated, but not more than 4 inches (102 mm) thick or less than the thickness allowed by ASTM C 1397.
  4. Channeled Board Insulation: EIFS manufacturer's standard factory-fabricated profile with linear, vertical-drainage channels, slots, or waves on the back side of board.
  5. Foam Build-Outs: Provide with profiles and dimensions indicated on Drawings.
- F. Reinforcing Mesh: Balanced, alkali-resistant, open-weave, glass-fiber mesh treated for compatibility with other EIFS materials, made from continuous multiend strands with retained mesh tensile strength of not less than 120 lbf/in. (21 dN/cm) according to ASTM E 2098 and the following:
1. Reinforcing Mesh for EIFS, General: Not less than weight required to meet impact-performance level specified in "Performance Requirements" Article.
  2. Strip Reinforcing Mesh: Not less than As recommended by EIFS manufacturer.
  3. Detail Reinforcing Mesh: Not less than As recommended by EIFS manufacturer.
  4. Corner Reinforcing Mesh: Not less than As recommended by EIFS manufacturer.
- G. Base-Coat Materials: EIFS manufacturer's standard mixture complying with the following:
1. Factory-blended dry formulation of portland cement, dry polymer admixture, and inert fillers to which only water is added at Project site.
- H. Primer: EIFS manufacturer's standard factory-mixed, elastomeric-polymer primer for preparing base-coat surface for application of finish coat.
- I. Finish-Coat Materials: EIFS manufacturer's siliconized acrylic-based coating complying with the following:
1. Factory-mixed formulation of polymer-emulsion binder, colorfast mineral pigments, sound stone particles, and fillers.
  2. Colors: Match Architect's sample.
  3. Textures: As selected by Architect from manufacturer's full range.
- J. Water: Potable.
- K. Trim Accessories: Type as designated or required to suit conditions indicated and to comply with EIFS manufacturer's written instructions; manufactured from UV-stabilized PVC; and complying with ASTM D 1784, manufacturer's standard cell class for use intended, and ASTM C 1063.
1. Casing Bead: Prefabricated, one-piece type for attachment behind insulation, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.
  2. Drip Screed/Track: Prefabricated, one-piece type for attachment behind insulation with face leg extended to form a drip, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg.



3. Weep Screed/Track: Prefabricated, one-piece type for attachment behind insulation with perforated face leg extended to form a drip and weep holes in track bottom, of depth required to suit thickness of coating and insulation, with face leg perforated for bonding to coating and back leg; designed to drain incidental moisture that gets into wall construction to the exterior at terminations of EIFS with drainage.
4. Expansion Joint: Prefabricated, one-piece V profile; designed to relieve stress of movement.
5. Windowsill Flashing: Prefabricated type for both flashing and sloping sill over framing beneath windows; with end and back dams; designed to direct water to exterior.
6. Parapet Cap Flashing: Type for both flashing and covering parapet top with design complying with ASTM C 1397.

## 2.4 MIXING

- A. Comply with EIFS manufacturer's requirements for combining and mixing materials. Do not introduce admixtures, water, or other materials except as recommended by EIFS manufacturer. Mix materials in clean containers. Use materials within time period specified by EIFS manufacturer or discard.

## 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 the Work.
- B. Examine roof edges, wall framing, flashings, openings, substrates, and junctures at other construction for suitable conditions where EIFS will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
  1. Begin coating application only after surfaces are dry.
  2. Application of coating indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Protect contiguous work from moisture deterioration and soiling caused by application of EIFS. Provide temporary covering and other protection needed to prevent spattering of exterior finish coats on other work.
- B. Protect EIFS, substrates, and wall construction behind them from inclement weather during installation. Prevent penetration of moisture behind drainage plane of EIFS and deterioration of substrates.

- C. Prepare and clean substrates to comply with EIFS manufacturer's written instructions to obtain optimum bond between substrate and adhesive for insulation.
  - 1. Concrete Substrates: Provide clean, dry, neutral-pH substrate for insulation installation. Verify suitability of substrate by performing bond and moisture tests recommended by EIFS manufacturer.

### 3.3 EIFS INSTALLATION, GENERAL

- A. Comply with ASTM C 1397, ASTM E 2511, and EIFS manufacturer's written instructions for installation of EIFS as applicable to each type of substrate indicated.

### 3.4 SUBSTRATE PROTECTION APPLICATION

- A. Primer/Sealer: Apply over substrates and where required by EIFS manufacturer for improving adhesion of insulation to substrate.
- B. Water-Resistive Coating: Apply over sheathing to provide a water-resistive barrier.
  - 1. Tape and seal joints, exposed edges, terminations, and inside and outside corners of sheathing unless otherwise indicated by EIFS manufacturer's written instructions.
- C. Flexible-Membrane Flashing: Install over weather-resistive barrier, applied and lapped to shed water; seal at openings, penetrations, terminations, and where required by EIFS manufacturer. Prime substrates if required and install flashing to comply with EIFS manufacturer's written instructions and details.

### 3.5 TRIM INSTALLATION

- A. Trim: Apply trim accessories at perimeter of EIFS, at expansion joints, at window sills, and elsewhere as indicated. Coordinate with installation of insulation.
  - 1. Weep Screed/Track: Use at bottom termination edges, at window and door heads, and at floor line expansion joints of water-drainage EIFS unless otherwise indicated.
  - 2. Window Sill Flashing: Use at windows unless otherwise indicated.
  - 3. Expansion Joint: Use where indicated on Drawings.
  - 4. Casing Bead: Use at other locations.
  - 5. Parapet Cap Flashing: Use where indicated on Drawings.

### 3.6 INSULATION INSTALLATION

- A. Board Insulation: Adhesively attach insulation to substrate in compliance with ASTM C 1397 and the following:

1. Apply adhesive to insulation by notched-trowel method, with notches oriented vertically to produce drainage channels that remain functional after the insulation is adhered to substrate.
  - a. Provide manufacturer representative letter stating that adhesive was inspected and applied per manufacturer standard recommendations.
2. Press and slide insulation into place. Apply pressure over the entire surface of insulation to accomplish uniform contact, high initial grab, and overall level surface.
3. Allow adhered insulation to remain undisturbed for not less than 24 hours, before beginning rasping and sanding insulation or applying base coat and reinforcing mesh.
4. Apply insulation over substrates in courses with long edges of boards oriented horizontally.
5. Begin first course of insulation from screed/track and work upward. Work from perimeter casing beads toward interior of panels if possible.
6. Stagger vertical joints of insulation boards in successive courses to produce running bond pattern. Locate joints so no piece of insulation is less than 12 inches (300 mm) wide or 6 inches (150 mm) high. Offset joints not less than 6 inches (150 mm) from corners of window and door openings and not less than 4 inches (100 mm) from aesthetic reveals.
  - a. Adhesive Attachment: Offset joints of insulation not less than 6 inches (150 mm) from horizontal and 4 inches (100 mm) from vertical joints in sheathing.
7. Interlock ends at internal and external corners.
8. Abut insulation tightly at joints within and between each course to produce flush, continuously even surfaces without gaps or raised edges between boards. If gaps greater than 1/16 inch (1.6 mm) occur, fill with insulation cut to fit gaps exactly; insert insulation without using adhesive or other material.
9. Cut insulation to fit openings, corners, and projections precisely and to produce edges and shapes complying with details indicated.
10. Rasp or sand flush entire surface of insulation to remove irregularities projecting more than 1/32 inch (0.8 mm) from surface of insulation and to remove yellowed areas due to sun exposure; do not create depressions deeper than 1/16 inch (1.6 mm). Prevent airborne dispersal and immediately collect insulation raspings or sandings.
11. Cut aesthetic reveals in outside face of insulation with high-speed router and bit configured to produce grooves, rabbets, and other features that comply with profiles and locations indicated. Do not reduce insulation thickness at aesthetic reveals to less than 3/4 inch (19 mm).
12. Install foam build-outs and attach to sheathing.
13. Interrupt insulation for expansion joints where indicated.
14. Form joints for sealant application with back-to-back casing beads for joints within EIFS and with perimeter casing beads at dissimilar adjoining surfaces. Make gaps between casing beads and between perimeter casing beads and adjoining surfaces of width indicated.
15. After installing insulation and before applying field-applied reinforcing mesh, fully wrap board edges. Cover edges of board and extend encapsulating mesh not

less than 2-1/2 inches (64 mm) over front and back face unless otherwise indicated on Drawings.

16. Treat exposed edges of insulation as follows:

- a. Except for edges forming substrates of sealant joints, encapsulate with base coat, reinforcing mesh, and finish coat.
- b. Encapsulate edges forming substrates of sealant joints within EIFS or between EIFS and other work with base coat and reinforcing mesh.
- c. At edges trimmed by accessories, extend base coat, reinforcing mesh, and finish coat over face leg of accessories.

17. Coordinate installation of flashing and insulation to produce wall assembly that does not allow water to penetrate behind flashing and water-resistive barrier.

B. Expansion Joints: Install at locations indicated, where required by EIFS manufacturer, and as follows:

1. At expansion joints in substrates behind EIFS.
2. Where EIFS adjoin dissimilar substrates, materials, and construction, including other EIFS.
3. Where wall height or building shape changes.
4. Where EIFS manufacturer requires joints in long continuous elevations.

### 3.7 BASE-COAT INSTALLATION

- A. Base Coat: Apply to exposed surfaces of insulation and foam build-outs in minimum thickness recommended in writing by EIFS manufacturer, but not less than 1/16-inch (1.6-mm) dry-coat thickness.
- B. Reinforcing Mesh: Embed reinforcing mesh in wet base coat to produce wrinkle-free installation with mesh continuous at corners, overlapped not less than 2-1/2 inches (64 mm) or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written instructions. Do not lap reinforcing mesh within 8 inches (204 mm) of corners. Completely embed mesh, applying additional base-coat material if necessary, so reinforcing-mesh color and pattern are invisible.
- C. Double-Layer Reinforcing-Mesh Application: Where indicated or required, apply second base coat and second layer of reinforcing mesh, overlapped not less than 2-1/2 inches (64 mm) or otherwise treated at joints to comply with ASTM C 1397 and EIFS manufacturer's written instructions in same manner as first application. Do not apply until first base coat has cured.
- D. Additional Reinforcing Mesh: Apply strip reinforcing mesh around openings, extending 4 inches (100 mm) beyond perimeter. Apply additional 9-by-12-inch (230-by-300-mm) strip reinforcing mesh diagonally at corners of openings (re-entrant corners). Apply 8-inch- (200-mm-) wide, strip reinforcing mesh at both inside and outside corners unless base layer of mesh is lapped not less than 4 inches (100 mm) on each side of corners.
  1. At aesthetic reveals, apply strip reinforcing mesh not less than 8 inches (200 mm) wide.

2. Embed strip reinforcing mesh in base coat before applying first layer of reinforcing mesh.

- E. Foam Build-Outs: Fully embed reinforcing mesh in base coat.
- F. Double Base-Coat Application: Where indicated, apply second base coat in same manner and thickness as first application, except without reinforcing mesh. Do not apply until first base coat has cured.

### 3.8 FINISH-COAT INSTALLATION

- A. Primer: Apply over dry base coat according to EIFS manufacturer's written instructions.
- B. Finish Coat: Apply over dry primed base coat, maintaining a wet edge at all times for uniform appearance, in thickness required by EIFS manufacturer to produce a uniform finish of color and texture matching approved sample and free of cold joints, shadow lines, and texture variations.

### 3.9 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
  1. As stipulated in Ch. 17 of the IBC.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. EIFS Tests and Inspections: According to ICC-ES AC219.
- D. EIFS will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

### 3.10 CLEANING AND PROTECTION

- A. Remove temporary covering and protection of other work. Promptly remove coating materials from window and door frames and other surfaces outside areas indicated to receive EIFS coatings.

END OF SECTION 072419

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## SECTION 072616 – BELOW-GRADE VAPOR RETARDERS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section Includes:
  - 1. Below-grade vapor retarders.
- B. Related Requirements:
  - 1. Section 033000 "Cast-in-Place Concrete."

## 1.3 ACTION SUBMITTALS

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

## 1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

## PART 2 - PRODUCTS

## 2.1 MATERIALS

- A. Vapor Retarders: ASTM E 1745 Class A, minimum 15-mil- (0.38-mm-) thick sheet with maximum permeance rating of 0.01 perm (.57 ng/Pa x s x sq. m).
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Raven Industries, Inc; VAPORBLOCK VB15.
    - b. Stego Industries, LLC; Stego Wrap 15 mil Class A.
    - c. W. R. Grace & Co.; Florprufe 120.
    - d. W. R. Meadows, Inc.; Perminator 15 mil.

## 2.2 ACCESSORIES

- A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- B. Mastic for Vapor Retarders: Product recommended by vapor-retarder manufacturer for sealing pipe and utility penetrations.
- C. Pipe Boots: Manufacturer's recommended pipe boots/collars for pipe and utility penetrations.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Prepare surfaces in accordance with manufacturer's instructions.
- B. Level, tamp, or roll earth or granular material beneath the slab base.

### 3.2 INSTALLATION

- A. Install vapor barrier in accordance with manufacturer's instructions and ASTM E 1643.
- B. Unroll vapor barrier with the longest dimension parallel with the direction of the concrete placement.
- C. Lap vapor barrier over footings and seal to foundation walls.
- D. Overlap joints 6 inches (152.4 mm) and seal with manufacturer's tape.
- E. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape, mastic, or pipe boot to create an airtight seal between penetrating objects and vapor retarder.
- F. No penetration of the vapor retarder is allowed except for reinforcing steel and permanent utilities.
- G. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches (152.4 mm) and taping all four sides with tape.

### 3.3 PROTECTION

- A. Protect vapor retarders from damage until concealed by permanent construction.

END OF SECTION 072616



## SECTION 072726 - FLUID-APPLIED MEMBRANE AIR BARRIERS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section Includes:
  - 1. Vapor-retarding, fluid-applied air barriers.
- B. Related Requirements:
  - 1. Section 061600 "Sheathing" for wall sheathings and wall sheathing joint-and-penetration treatments.

## 1.3 DEFINITIONS

- A. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.
- B. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.
- C. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

## 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review air-barrier requirements and installation, special details, mockups, air-leakage and bond testing, air-barrier protection, and work scheduling that covers air barriers.

## 1.5 ACTION SUBMITTALS

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

1. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; dry film thickness; and tested physical and performance properties of products.

B. Shop Drawings: For air-barrier assemblies.

1. Show locations and extent of air-barrier materials, accessories, and assemblies specific to Project conditions.
2. Include details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
3. Include details of interfaces with other materials that form part of air barrier.

## 1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Certificates: From air-barrier manufacturer, certifying compatibility of air barriers and accessory materials with Project materials that connect to or that come in contact with the barrier.

C. Product Test Reports: For each air-barrier assembly, for tests performed by a qualified testing agency.

D. Field quality-control reports.

## 1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Mockups: Build mockups to set quality standards for materials and execution.

1. Build integrated mockups of exterior wall assembly, incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
  - a. Coordinate construction of mockups to permit inspection and testing of air barrier before external insulation and cladding are installed.
  - b. Include junction with roofing membrane and foundation wall intersection.
  - c. If Architect determines mockups do not comply with requirements, reconstruct mockups and apply air barrier until mockups are approved.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Remove and replace liquid materials that cannot be applied within their stated shelf life.
- B. Protect stored materials from direct sunlight.

## 1.9 FIELD CONDITIONS

- A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.
  - 1. Protect substrates from environmental conditions that affect air-barrier performance.
  - 2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

# PART 2 - PRODUCTS

## 2.1 MATERIALS

- A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction shall be capable of performing as a continuous air barrier and as a liquid-water drainage plane flashed to discharge to the exterior incidental condensation or water penetration. Air-barrier assemblies shall be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.
- B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. (0.2 L/s x sq. m of surface area at 75 Pa), when tested according to ASTM E 2357.

## 2.3 HIGH-BUILD AIR BARRIERS, VAPOR RETARDING

- A. High-Build, Vapor-Retarding Air Barrier: Modified bituminous or synthetic polymer membrane with an installed dry film thickness, according to manufacturer's written instructions, of 35 mils (0.9 mm) or thicker over smooth, void-free substrates.
  - 1. Modified Bituminous Type:
    - a. Products: Subject to compliance with requirements, provide one of the following:

- 1) Carlisle Coatings & Waterproofing Inc; Barriseal VP.
- 2) Henry Company, Sealants Division; Air-Bloc 31MR.
- 3) Hohmann & Barnard, Inc; Enviro-Barrier.
- 4) Tremco Incorporated; ExoAir 230.
- 5) W. R. Meadows, Inc; Air-Shield LMP.

2. Synthetic Polymer Type:

- a. Products: Subject to compliance with requirements, provide one of the following:

- 1) Carlisle Coatings & Waterproofing Inc; Fire Resist Barritech NP.
- 2) Grace Construction Products; W.R. Grace & Co. -- Conn.; Perm-A-Barrier Liquid.
- 3) Henry Company; Air-Bloc 32MR.
- 4) W. R. Meadows, Inc; Air-Shield LSR.

3. Physical and Performance Properties:

- a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa) pressure difference; ASTM E 2178.
- b. Vapor Permeance: Maximum 0.1 perm (5.8 ng/Pa x s x sq. m); ASTM E 96/E 96M, Desiccant Method.
- c. Ultimate Elongation: Minimum 500 percent; ASTM D 412, Die C.
- d. Adhesion to Substrate: Minimum 16 lbf/sq. in. (110 kPa) when tested according to ASTM D 4541.
- e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
- f. UV Resistance: Can be exposed to sunlight for 60 days according to manufacturer's written instructions.

2.4 MEDIUM-BUILD AIR BARRIERS, VAPOR RETARDING

- A. Medium-Build, Vapor-Retarding Air Barrier: Synthetic polymer material with an installed dry film thickness, according to manufacturer's written instructions, of 17 to 30 mils (0.4 to 0.8 mm) over smooth, void-free substrates.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. BASF Corporation; Wall Systems; Enershield-I.
- b. PROSOCO, Inc; R-Guard VB.
- c. Sto Corp; StoGuard VaporSeal.

2. Physical and Performance Properties:

- a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa) pressure difference; ASTM E 2178.

- b. Vapor Permeance: Maximum 0.1 perm (5.8 ng/Pa x s x sq. m); ASTM E 96/E 96M, Desiccant Method.
- c. Ultimate Elongation: Minimum 350 percent; ASTM D 412, Die C.
- d. Adhesion to Substrate: Minimum 16 lbf/sq. in. (110 kPa) when tested according to ASTM D 4541.
- e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
- f. UV Resistance: Can be exposed to sunlight for 90 days according to manufacturer's written instructions.

## 2.5 LOW-BUILD AIR BARRIERS, VAPOR RETARDING

- A. Low-Build, Vapor-Retarding Air Barrier: Synthetic polymer material with an installed dry film thickness, according to manufacturer's written instructions, of 6 to 15 mils (1.5 to 0.38 mm) over smooth, void-free substrates.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Polyguard Products, Inc.; Polyguard Airlok Flex.
    - b. Sto Corp; Sto Gold Coat.
  - 2. Physical and Performance Properties:
    - a. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57-lbf/sq. ft. (0.02 L/s x sq. m of surface area at 75-Pa) pressure difference; ASTM E 2178.
    - b. Vapor Permeance: Maximum 0.1 perm (5.8 ng/Pa x s x sq. m); ASTM E 96/E 96M, Desiccant Method.
    - c. Ultimate Elongation: Minimum 350 percent; ASTM D 412, Die C.
    - d. Adhesion to Substrate: Minimum 16 lbf/sq. in. (110 kPa) when tested according to ASTM D 4541.
    - e. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
    - f. UV Resistance: Can be exposed to sunlight for 90 days according to manufacturer's written instructions.

## 2.6 ACCESSORY MATERIALS

- A. Requirement: Provide primers, transition strips, termination strips, joint reinforcing fabric and strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.
- B. Primer: Liquid solvent-borne primer recommended for substrate by air-barrier material manufacturer.

- C. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, 0.0187 inch (0.5 mm) thick, and Series 300 stainless-steel fasteners.
- D. Preformed Silicone Extrusion: Manufacturer's standard system consisting of cured low-modulus silicone extrusion, sized to fit opening widths, with a single-component, neutral-curing, Class 100/50 (low-modulus) silicone sealant for bonding extrusions to substrates.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Dow Corning Corporation; Dow Corning® 123 Silicone Seal.
    - b. Pecora Corporation; Sil-Span.
    - c. Tremco Incorporated; Spectrem Simple Seal.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
  - 1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
  - 2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
  - 3. Verify that substrates are visibly dry and free of moisture.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 SURFACE PREPARATION

- A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate according to manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.
- B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching material.
- E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

- G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.
- H. Bridge isolation joints, expansion joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement according to manufacturer's written instructions and details.

### 3.3 ACCESSORIES INSTALLATION

- A. Install accessory materials according to air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air and water barrier.
  - 1. Coordinate the installation of air barrier with installation of roofing membrane and base flashing to ensure continuity of air barrier with roofing membrane.
  - 2. Install transition strip on roofing membrane or base flashing so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate.
  - 3. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
  - 4. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
- B. Connect and seal exterior wall air-barrier material continuously to roofing-membrane air barrier, concrete below-grade structures, floor-to-floor construction, exterior glazing and window systems, glazed curtain-wall systems, storefront systems, exterior louvers, exterior door framing, and other construction used in exterior wall openings, using accessory materials.
- C. At end of each working day, seal top edge of strips and transition strips to substrate with termination mastic.
- D. Apply joint sealants forming part of air-barrier assembly within manufacturer's recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- E. Wall Openings: Prime concealed, perimeter frame surfaces of windows, curtain walls, storefronts, and doors. Apply transition strip so that a minimum of 3 inches (75 mm) of coverage is achieved over each substrate. Maintain 3 inches (75 mm) of full contact over firm bearing to perimeter frames, with not less than 1 inch (25 mm) of full contact.
  - 1. Transition Strip: Roll firmly to enhance adhesion.
- F. Fill gaps in perimeter frame surfaces of windows, curtain walls, storefronts, and doors, and miscellaneous penetrations of air-barrier material with foam sealant.
- G. Seal strips and transition strips around masonry reinforcing or ties and penetrations with termination mastic.

- H. Seal top of through-wall flashings to air barrier with an additional 6-inch- (150-mm-) wide, transition strip.
- I. Seal exposed edges of strips at seams, cuts, penetrations, and terminations not concealed by metal counterflashings or ending in reglets with termination mastic.
- J. Repair punctures, voids, and deficient lapped seams in strips and transition strips. Slit and flatten fishmouths and blisters. Patch with transition strips extending 6 inches (150 mm) beyond repaired areas in strip direction.

### 3.4 PRIMARY AIR-BARRIER MATERIAL INSTALLATION

- A. Apply air-barrier material to form a seal with strips and transition strips and to achieve a continuous air barrier according to air-barrier manufacturer's written instructions and details. Apply air-barrier material within manufacturer's recommended application temperature ranges.
  - 1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
  - 2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.
  - 3. Where multiple prime coats are needed to achieve required bond, allow adequate drying time between coats.
- B. High-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply air-barrier material in full contact around protrusions such as masonry ties.
  - 1. Vapor-Retarding, High-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, but not less than 35 mils (0.9 mm), applied in one coat.
- C. Medium-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply an increased thickness of air-barrier material in full contact around protrusions such as masonry ties.
  - 1. Vapor-Retarding, Medium-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, but not less than 17 mils (0.4 mm), applied in one coat. Apply additional material as needed to achieve void- and pinhole-free surface.
- D. Low-Build Air Barriers: Apply continuous unbroken air-barrier material to substrates according to the following thickness. Apply an increased thickness of air-barrier material in full contact around protrusions such as masonry ties.
  - 1. Vapor-Retarding, Low-Build Air Barrier: Total dry film thickness as recommended in writing by manufacturer to comply with performance requirements, but not less than 6 mils (1.5 mm), applied in one coat. Apply additional material as needed to achieve void- and pinhole-free surface.



- E. Do not cover air barrier until it has been tested and inspected by testing agency.
- F. Correct deficiencies in or remove air barrier that does not comply with requirements; repair substrates and reapply air-barrier components.

### 3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Inspections: Air-barrier materials, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:
  - 1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
  - 2. Air-barrier dry film thickness.
  - 3. Continuous structural support of air-barrier system has been provided.
  - 4. Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
  - 5. Site conditions for application temperature and dryness of substrates have been maintained.
  - 6. Maximum exposure time of materials to UV deterioration has not been exceeded.
  - 7. Surfaces have been primed, if applicable.
  - 8. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
  - 9. Termination mastic has been applied on cut edges.
  - 10. Strips and transition strips have been firmly adhered to substrate.
  - 11. Compatible materials have been used.
  - 12. Transitions at changes in direction and structural support at gaps have been provided.
  - 13. Connections between assemblies (air-barrier and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
  - 14. All penetrations have been sealed.
- C. Tests: As determined by testing agency from among the following tests:
  - 1. Air-Leakage-Location Testing: Air-barrier assemblies will be tested for evidence of air leakage according to ASTM E 1186, chamber pressurization or depressurization with smoke tracers.
  - 2. Air-Leakage-Volume Testing: Air-barrier assemblies will be tested for air-leakage rate according to ASTM E 783.
  - 3. Adhesion Testing: Air-barrier assemblies will be tested for required adhesion to substrate according to ASTM D 4541 for each 600 sq. ft. (56 sq. m) of installed air barrier or part thereof.
- D. Air barriers will be considered defective if they do not pass tests and inspections.

1. Apply additional air-barrier material, according to manufacturer's written instructions, where inspection results indicate insufficient thickness.
  2. Remove and replace deficient air-barrier components for retesting as specified above.
- E. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.
- F. Prepare test and inspection reports.

### 3.6 CLEANING AND PROTECTION

- A. Protect air-barrier system from damage during application and remainder of construction period, according to manufacturer's written instructions.
1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials according to air-barrier manufacturer's written instructions.
  2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.
- B. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended in writing by manufacturer of affected construction.
- C. Remove masking materials after installation.

END OF SECTION 072726

## SECTION 074113.16 - STANDING-SEAM METAL ROOF PANELS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section includes standing-seam metal roof panels.
- B. Related Sections:
  - 1. Section 074293 "Soffit Panels" for metal panels used in horizontal soffit applications.
  - 2. Section 077253 "Snow Guards" for prefabricated devices designed to hold snow on the roof surface, allowing it to melt and drain off slowly.

## 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of roof accessories and roof-mounted equipment.
  - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
  - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
  - 5. Review structural loading limitations of deck during and after roofing.
  - 6. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.
  - 7. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
  - 8. Review temporary protection requirements for metal panel systems during and after installation.
  - 9. Review procedures for repair of metal panels damaged after installation.
  - 10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

#### 1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Sustainable Design Submittals:

1. Product Test Reports: For roof materials, documentation indicating that roof materials comply with Solar Reflectance Index requirements.
2. Product Data: For recycled content, indicating postconsumer and preconsumer recycled content and cost.

C. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 3 inches per 12 inches.

D. Calculations:

1. Include calculations with registered engineer seal, verifying roof panel and attachment method resist wind pressures imposed on it pursuant to applicable building codes.

E. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

F. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.

1. Metal Panels: 12 inches long by actual panel width. Include clips, fasteners, closures, and other metal panel accessories.

#### 1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Manufacturer and Installer.

B. Product Test Reports: For each product, for tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For special warranties.

## 1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.

## 1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in architectural sheet metal products.
- B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
  - 1. Build mockup of typical roof area and eave[, including fascia, and soffit as shown on Drawings; approximately 48 inches square by full thickness, including attachments[, underlayment, and accessories.
  - 2. Build mockups for typical roof area only, including accessories.
    - a. Size: 48 inches by 48 inches .
  - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels until installation. Remove as panels are being installed. Verify film is not left on installed panels.

## 1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

## 1.10 COORDINATION

- A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.
- B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

## 1.11 WARRANTY

- A. Special Galvalume Substrate Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including rupturing, or perforating.
    - b. Deterioration of metals and other materials beyond normal weathering.
  - 2. Warranty Period: 20 years and 6 months from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - c. Cracking, chipping, peeling, or failure of paint to adhere to bare metal.
  - 2. Finish Warranty Period: 20 years from date of Substantial Completion.
- C. Special Watertightness Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace standing-seam metal roof panel assemblies that fail to remain watertight, including leaks, within specified warranty period.
  - 1. Warranty Period: 15 years from date of Substantial Completion.
  - 2. Shop drawings must be provided to, reviewed, and approved by panel manufacturer prior to panel system installation.

3. Inspections by panel system manufacturer technical representative are required. Perform first inspection when underlayment and flashing are in place and second inspection when the roof is complete.
- D. Special Installer Warranty: Furnish a written warranty signed by the Panel Applicator guaranteeing materials and workmanship for watertightness of the roofing system, flashings, penetrations, and against all leaks.
  1. Warranty Period: Two years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 29 percent.
- B. Solar Reflectance Index (SRI): Three-year-aged SRI not less than 64 or initial SRI not less than 82] when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
- C. Energy Performance: Provide roof panels that are listed on the EPA/DOE's ENERGY STAR "Roof Product List" for steep-slope roof products.
- D. Energy Performance: Provide roof panels according to one of the following when tested according to CRRC-1:
  1. Three-year, aged solar reflectance of not less than 0.55 and emissivity of not less than 0.75.
  2. Three-year, aged Solar Reflectance Index of not less than 64 when calculated according to ASTM E 1980.
- E. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
  1. Wind Loads: As indicated on Drawings.
  2. Other Design Loads: As indicated on Drawings.
  3. Deflection Limits: For wind loads, no greater than 1/240 of the span.
- F. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 1680 and ASTM E 283 at the following test-pressure difference:
  1. Test-Pressure Difference: 6.24 lbf/sq. ft. (300 Pa).
- G. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 1646 and ASTM E 331 at the following test-pressure difference:
  1. Test-Pressure Difference: 15 lbf/sq. ft. (718.2 Pa).

- H. Hydrostatic Head Resistance: No water penetration when tested according to ASTM E2140.
- I. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
  - 1. Uplift Rating: UL 90.
- J. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

## 2.2 STANDING-SEAM METAL ROOF PANELS

- A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
  - 1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1514.
  - 2. Aluminum Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E 1637.
- B. Vertical-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and panel to match campus standard between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and mechanically seaming panels together.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Berridge Manufacturing Company; Zee-lock (90° seam).
  - 2. Metallic-Coated Steel Sheet: Aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
    - a. Nominal Thickness: 0.029 inch.
    - b. Exterior Finish: Two-coat fluoropolymer.
    - c. Painted materials shall have a removable plastic film to protect the paint during roll forming, shipping and handling.
    - d. Color: As selected by Architect from manufacturer's full range.
  - 3. Clips: Zee-Clip to accommodate thermal movement.



- a. Material: 0.024-inch nominal thickness, zinc-coated (galvanized) or aluminum-zinc alloy-coated steel sheet
4. Joint Type: Single folded.
5. Panel Coverage: 16 inches.
6. Panel Height: 2.0 inches.

## 2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 40 mils thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.
  1. Thermal Stability: Stable after testing at 240 deg F ; ASTM D 1970.
  2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.
  3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Mid-States Asphalt Quick Stick HT Pro
    - b. Polyglass Polystick MTS
    - c. Soprema Lastobond Shield HT
    - d. Tamko TW Underlayment or TW Metal & Tile Underlayment

## 2.4 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C 645; cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
  1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
  2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed

openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

- D. Gutters: Formed from same material as roof panels, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 96-inch long sections, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced a maximum of 36 inches o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match roof fascia and rake trim.
- E. Downspouts: Formed from same material as roof panels. Fabricate in 10-foot long sections, complete with formed elbows and offsets, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual." Finish downspouts to match gutters.
- F. Roof Curbs: Fabricated from same material as roof panels, 0.029 inch nominal thickness; galvalume or stainless steel; supply an integral full-length cricket for curbs wider than 24 inches supported by a structural metal deck. Fabricate curb flashing from 0.029 inch. On open framing, provide roof underlayment and decking at and about roof curb per roofing manufacturer's requirements. Maintain a minimum of 1/2 of roofing panel width on each side of roof curb, and start panels a minimum of 9 inches up slope of roof curb, flashing roofing panels to roof curb per roofing manufacturer's requirements.. Fabricate curb and subframing to withstand indicated loads of size and height of roof top equipment. Where required insulate roof curbs with rigid insulation.
- G. Panel Fasteners: Zinc-coated steel, corrosion resisting steel, zinc cast head, or nylon capped steel, type and size as approved for the applicable loading requirements.
- H. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
  - 1. Joint Sealant: Silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.

## 2.5 FABRICATION

- A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. On-Site Fabrication: Subject to compliance with requirements of this Section, metal panels may be fabricated on-site using factory set, non-adjustable, portable roll-forming equipment if panels are of same profile and warranted by manufacturer to be equal to factory-formed panels. Fabricate according to equipment manufacturer's written instructions and to comply with details shown.

- C. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
  - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
  - 2. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
  - 3. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
    - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application, but not less than thickness of metal being secured.

## 2.6 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. 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 same piece are unacceptable. 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.
- C. Steel Panels and Accessories:
  - 1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat applied by panel manufacturer on a continuous coil coating line, with a top side dry film thickness of  $0.75 \pm 0.05$  mil over  $0.2 \pm 0.05$  mil primer coat, to provide a total dry film thickness of  $0.95 \pm 0.10$  mil. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 2. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.35 mil.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
  - 1. Examine primary and secondary roof framing to verify that rafters, purlins, angles, channels, and other structural panel support members and anchorages have been installed within alignment tolerances required by metal roof panel manufacturer.
  - 2. Examine solid roof sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal roof panel manufacturer.
    - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

### 3.3 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated below, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 36 inches. Roll laps with roller. Cover underlayment within 14 days or as directed by the underlayment product manufacturer.
  - 1. Apply over the entire roof surface.
- B. Alternate : Felt Underlayment with Self-Adhering Sheet Underlayment applied at locations indicated below, in shingle fashion to shed water, and with lapped joints of not less than 2 inches.

1. At minimum apply Self-Adhering Sheet Underlayment over the roof area indicated below:
    - a. Roof perimeter for a distance up from eaves of 36 inches beyond interior wall line.
    - b. Valleys, from lowest point to highest point, for a distance on each side of 18 inches. Overlap ends of sheets not less than 6 inches.
    - c. Rake edges for a distance of 18 inches.
    - d. Hips and ridges for a distance on each side of 12 inches.
    - e. Roof-to-wall intersections for a distance from wall of 18 inches.
  2. Apply type II 30 lb. Felt Underlayment on roof not covered by self-adhering sheet underlayment. Lap over edges of self-adhering sheet underlayment not less than 6 inches, in shingle fashion to shed water.
- C. Flashings: Install flashings to cover underlayment to comply with requirements specified in Section 076200 "Sheet Metal Flashing and Trim."

### 3.4 METAL PANEL INSTALLATION

- A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Shim or otherwise plumb substrates receiving metal panels to be level to 1/4 inch in 20 ft..
  2. Flash and seal metal panels at perimeter of all openings. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
  3. Locate and space fastenings in uniform vertical and horizontal alignment.
  4. Install flashing and trim as metal panel work proceeds.
  5. Panels should be continuous without end laps.
  6. Align bottoms of metal panels and fasten.
  7. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
  2. Aluminum Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use stainless-steel fasteners for surfaces exposed to the interior.
- C. Anchor Clips: Anchor metal roof panels and other components of the Work securely in place, using manufacturer's approved fasteners according to manufacturers' written instructions.
- D. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

- E. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.
  - 1. Install clips to supports with self-tapping fasteners.
  - 2. Install pressure plates, if required, at locations indicated in manufacturer's written installation instructions.
  - 3. Seamed Joint: Crimp standing seams with manufacturer-approved, motorized seamer tool so clip, metal roof panel, and factory-applied vinyl weatherseal are completely engaged.
- F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
  - 1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, and similar items. Provide types indicated by metal roof panel manufacturers; or, if not indicated, types recommended by metal roof panel manufacturer.
- G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.
  - 1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof and weather-resistant performance.
  - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
- H. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.
- I. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.
  - 1. Provide elbows at base of downspouts to direct water away from building.
  - 2. Connect downspouts to underground drainage system indicated.
- J. Roof Curbs: Install flashing around bases where they meet metal roof panels.
- K. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

### 3.5 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines as indicated and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

### 3.6 FIELD QUALITY CONTROL

- A. Remove and replace applications of metal roof panels where tests and inspections indicate that they do not comply with specified requirements.
- B. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- C. Prepare test and inspection reports.

### 3.7 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 074113.16

## SECTION 074646 – FIBER CEMENT SIDING

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

## A. Section Includes:

1. Mineral-fiber cement horizontal lapped siding.
2. Mineral-fiber cement vertical siding panels.
3. Mineral-fiber cement trim.
4. Extruded aluminum trims.
5. Accessory materials for siding.

## B. Related Requirements:

1. Section 054000 - Cold-Formed Metal Framing
2. Section 061600 "Sheathing"
3. Section 061000 "Rough Carpentry" for wood framing.
4. Section 076200 "Sheet metal Flashing and trim"
5. Section 072726 "Fluid applied Membrane Air Barriers"
6. Section 079200 "Joint Sealants"
7. Section 099120 "Painting & Coatings"

## C. Coordination:

Coordinate siding installation with flashings and other adjoining construction to ensure proper sequencing.

## 1.3 ACTION SUBMITTALS

## A. Product Data: For each product indicated.

1. Also include Material Safety Data Sheet (MSTD) for fiber cement products.

## B. Manufacturer's instructions for installation of each specified product including safe handling requirements.

## C. Samples for Verification:

1. Fiber Cement Products: Samples in designated texture(s) for each product, approximately 8 inches by 8 inches by actual thickness.
2. For each extruded aluminum trim, approximately 12 inches long, in designated color(s).



- D. Contract Closeout Submittals:
  - 1. Manufacturer's maintenance instructions.
  - 2. Warranty: submit manufacturer's original warranty documents to Owner.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Approved and qualified by manufacturer to install specified products to maintain product warranty.
- B. Provide all fiber cement products from one manufacturer unless otherwise Indicated on drawings or approved by the Architect.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping:
  - 1. Deliver materials to Project site in original packaging with labels intact.
  - 2. Labels shall contain information regarding manufacturer's name and product type.
- B. Storage and Protection:
  - 1. Store materials under cover, off ground and concrete.
  - 2. Maintain neat, clean conditions in storage area; remove and waste material at end of each day's Work.
  - 3. Prohibit smoking in storage area.

#### 1.6 FIELD CONDITIONS

- A. Environmental requirements: Comply with manufacturer's recommendations regarding environmental conditions under which materials may be installed.
- B. Do not install panels that are wet, moisture damaged, and mold damaged.

#### 1.7 WARRANTY

- A. Base Warranty: Provide for warranty covering all materials and workmanship without limitation or qualification for the time period below as measured from date of Substantial Completion:
  - 1. 1 year.
- B. Special Extended Warranty: Provide manufacturer's standard extended warranty for each product type.

### PART 2 – PRODUCTS

#### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the following:

1. Acceptable Manufacturers: Subject to compliance with requirements, products of the following manufacturers comparable in type and quality are acceptable:
  - a. James Hardie Building Products, Inc.
  - b. Allura (includes products previously marketed as Certain-Teed).
  - c. Nichiha.
  - d. GAF Materials Corporation
  - e. Cemlank, Inc
- B. Source Limitations: Obtain products, including related accessories, from single source from single manufacturer.

## 2.2 FIBER CEMENT MATERIALS

Made from fiber-cement board that complies with ASTM C 1186, Type A, Grade II; classified as noncombustible when tested according to ASTM E 136; and has a flame-spread index of 25 or less when tested according to ASTM E 84

- A. Horizontal Lap Siding:
  1. Type: Horizontal lap siding.
  2. Nominal Size: Exposure varies for different parts of the facade as indicated on drawings. Provide siding width that provides 1-1/4 inch minimum overlap.
  3. Length: Longest length available from manufacturer to minimize seams and joints. Verify layout of joints with Architect prior to installation.
  4. Paint Finish: Manufacturer's standard primer.
  5. Texture: As selected by Architect from manufacturer's standards.
- B. Vertical Siding Panel:
  1. Type: Vertical siding panels.
  2. Nominal size: 4'-0" wide x 8', 9', or 10' long x 5/16" thick.
  3. Paint Finish: Manufacturer's standard primer.
  4. Texture: As indicated on drawings.
- C. Fiber Cement Trim:
  1. Type: Rectangular running trim.
  2. Nominal Face Width: As indicated on drawings.
  3. Actual Thickness: As indicated on drawings, either 1 inch (4/4") or 1-1/4 inch (5/4"). If thickness is not indicated, assume 1-1/4 inch for pricing purposes, to be confirmed by the Architect during the Submittal process.
  4. Length: Lengths as needed for locations indicated to avoid splices. Where continuous runs exceed standard lengths from manufacturer, provide longest length available to minimize the number of splices. Verify layout of joints with Architect prior to installation.

5. Paint Finish: Manufacturer's standard primer.
  6. Texture: As indicated on drawings.
- D. Factory Priming: Manufacturer's standard acrylic primer.
1. Horizontal Pattern: Boards [5-1/4 inches (133 mm)] [6-1/4 to 6-1/2 inches (159 to 165 mm)] [7-1/4 to 7-1/2 inches (184 to 190 mm)] [8-1/4 to 8-1/2 inches (210 to 216 mm)] [9-1/4 to 9-1/2 inches (235 to 241 mm)] <Insert size> wide in [plain] [beaded-edge] style and [smooth] [rough sawn] [wood grain] texture.

## 2.3 FIBER CEMENT SOFFIT

- A. Fiber-Cement Soffit: Panels with smooth texture, perforated made from fiber-cement board that complies with ASTM C 1186, Type A, Grade II; is classified as noncombustible when tested according to ASTM E 136; and has a flame-spread index of 25 or less when tested according to ASTM E 84

## 2.4 ALUMINUM TRIMS

- A. Extruded Aluminum Trims:
1. Basis-of-Design: Products as manufactured by EasyTrim Reveals, [www.easytrimreveals.com](http://www.easytrimreveals.com), specific products and profiles as indicated on drawings, or to the extent not indicated, as recommend by siding manufacturer.
  2. Acceptable Manufacturers: Subject to compliance with requirements, products of the following manufacturers comparable in type and quality are acceptable:
    - a. Easy Trim Reveals.
    - b. Fry Reglet Corporation.
    - c. Tamlyn.
- B. Trim Profiles: As indicated on drawings.
- C. Color/Finish: As selected by Architect from manufacturer's standards.

## 2.5 ACCESSORIES

- A. Fasteners: Stainless steel, aluminum, or hot-dip galvanized: types and sizes recommended by siding manufacturer for indicated substrates and framing.
- B. Installation Accessories and Trim: Provide manufacturer's standard installation accessories and trim pieces. Provide pieces required for siding installation or indicated on drawings, including, but not limited to, the following:
1. Starter strips.
  2. Corner posts, for Interior and exterior corners.
  3. Window and door trim:

- a. Jamb and head trim.
  - b. Undersill trim.
  - c. Head flashing.
  - d. Panel joint trim including battens.
  - e. Outside corner joint trim
- C. Furring Strips: Pressure treated 1x2's or similar as recommended by siding manufacturer.
- D. Sealant: As specified in Section 079200 "Joint Sealants."
- E. Field Painting: As specified in Section 099120 "Painting and Coatings."

## PART 3 – EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates for compliance with manufacturer requirements for installation tolerances and other conditions affecting performance and warranty of materials to be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected per manufacturer requirements.

### 3.2 INSTALLATION:

- A. Clean substrates of projections and substances detrimental to application.
- B. Coordinate installation with flashings and other adjoining construction to ensure proper sequencing.
- C. Install joint sealants as specified in Section 079200 "Joint Sealants" and to produce a weathertight installation.
- D. General:
  - 1. Follow all manufacturer recommended safety practices.
  - 2. Install materials in accordance with approved manufacturer's product data and installation instructions, and as indicated.
  - 3. Install Work plumb, level, true, and straight without distortions.
  - 4. Provide Work smooth, free from abrasion, tool marks, or similar defects on exposed surfaces.
  - 5. Furring Strips: Install furring strips vertically at each stud and as otherwise recommended by siding manufacturer.
    - a. Locations: Where required by siding manufacturer or where indicated on drawings.

- E. Horizontal Lap Siding:
1. Horizontal Installation:
    - a. Install siding over sheathing and required water-resistive barrier; stagger vertical siding joints at least one stud space.
    - b. Nail flush at each stud; do not countersink. Nail in accordance with manufacturer's requirements.
    - c. Maintain manufacturer's recommended space between siding and trim at butt joints.
  2. Provide fasteners of sufficient length to penetrate stud 1-1/2".
  3. Flashings:
    - a. Flash at all exterior, exposed to weather, door and window heads with flashings as specified in Division 07.
    - b. Wrap exterior corners with continuous building paper strip and fasten.
- F. Vertical Panel Siding Installation:
1. Install siding over sheathing and required water-resistive barrier.
  2. Nail flush at each stud: do not countersink. Nail in accordance with manufacturer's requirements.
  3. Maintain manufacturer's recommended space between siding and trim at butt joints.
  4. Provide fasteners of sufficient length penetrate stud 1-1/2".
  5. Install aluminum trim as indicated on drawings.
  6. Flashings:
    - a. Flash at all exterior, exposed to weather, door and window heads with flashing as specified in Division 07.
- G. Trim Installation:
1. Install trim over sheathing and required water-resistive barrier.
  2. Splices: Provide for 45 degree scarf joint.
    - a. At vertical trim, bevel cut shall angle downward from wall out in order to shed water.
  3. Nail flush at each stud: do not countersink. Nail in accordance with manufacturer's requirements.
  4. Maintain manufacturer's recommended space between trim and trim at butt joints.
  5. Provide fasteners of sufficient length penetrate stud 1-1/2".

### 3.3 CLEANING AND PAINTING

- A. Clean siding and accessory items using neutral cleaner approved by manufacturer.
- A. Painting: Siding surface shall be cleaned and prepared for painting as described in Section "Painting & Coatings"

3.4 PROTECTION

- A. Protect finished and prefinished surfaces from Work of other trades, mars, and stains until Date of Substantial Completion.
- B. Repair areas which are marred or stained: refinish entire area in locations in which repairs cannot be made.

END OF SECTION 07460

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## SECTION 076200 - 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 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

## A. Section Includes:

- 1. Reglets and counterflashing.
- 2. Roof sheet metal fabrications.
- 3. Formed equipment support flashing.

## B. Related Requirements:

- 1. Section 061000 "Rough Carpentry" for wood nailers, curbs, and blocking.
- 2. Section 075423 "Thermoplastic Polyolefin (TPO) Roofing" for installation of sheet metal flashing and trim integral with roofing.
- 3. Section 077200 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.

## 1.3 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leak proof, secure, and noncorrosive installation.

## 1.4 PREINSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct conference at Project site.
  - 1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
  - 3. Review requirements for insurance and certificates if applicable.



4. Review sheet metal flashing observation and repair procedures after flashing installation.

## 1.5 ACTION SUBMITTALS

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

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

### B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of roof-penetration flashing.
9. Include details of edge conditions and counter flashings as applicable.
10. Include details of special conditions.
11. Include details of connections to adjoining work.
12. Detail formed flashing and trim at scale of not less than 3 inches per 12 inches (1:5).

### C. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory-applied finishes.

### D. Samples for Verification: For each type of exposed finish.

1. Sheet Metal Flashing: 12 inches (300 mm) long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches (300 mm) long and in required profile. Include fasteners and other exposed accessories.
3. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.
4. Anodized Aluminum Samples: Samples to show full range to be expected for each color required.

## 1.6 INFORMATIONAL SUBMITTALS

### A. Qualification Data: For fabricator.

- B. Product Certificates: For each type of coping and roof edge flashing that is SPRI ES-1 tested.
- C. Product Test Reports: For each product, for tests performed by a qualified testing agency.

## 1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.

## 1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

## 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

# PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

## 2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Stainless-Steel Sheet: ASTM A 240/A 240M, Type 304, dead soft, fully annealed; with smooth, flat surface.
  1. Finish: 2B (bright, cold rolled).

## 2.3 UNDERLAYMENT MATERIALS

- A. Self-Adhering, High-Temperature Sheet: Minimum 40 mils (1.016 mm) thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Carlisle Coatings & Waterproofing Inc; CCW WIP 300HT.
    - b. Grace Construction Products; W.R. Grace & Co. -- Conn.; Grace Ice and Water Shield HT.
    - c. Polyguard Products, Inc.; Deck Guard HT.
  2. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F (116 deg C) or higher.
  3. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F (29 deg C) or lower.
- B. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. (0.16 kg/sq. m) minimum.

## 2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
  1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.

- a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
  - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
  - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
2. Fasteners for Stainless-Steel Sheet: Series 300 stainless steel.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.
- D. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- F. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.
- G. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

## 2.5 REGLETS AND COUNTERFLASHINGS

- A. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:
1. Stainless Steel: 0.025 inch (0.64 mm) thick.
  2. Corners: Factory mitered and mechanically clinched and sealed watertight.
  3. Surface-Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
- B. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches (100 mm) and in lengths not exceeding 12 feet (3.6 m) designed to snap into reglets and compress against base flashings with joints lapped, from the following exposed metal:
1. Stainless Steel: 0.025 inch (0.64 mm) thick.
- C. Accessories:
1. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

- D. Stainless-Steel Finish: No. 2B (bright, cold rolled, unpolished).

## 2.6 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
1. 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.
  2. Obtain field measurements for accurate fit before shop fabrication.
  3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
  4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with butyl sealant concealed within joints.
  2. Use lapped expansion joints only where indicated on Drawings.
- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard for application, but not less than thickness of metal being secured.
- G. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
- H. Do not use graphite pencils to mark metal surfaces.

## 2.7 ROOF SHEET METAL FABRICATIONS

- A. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
  - 1. Stainless Steel: 0.019 inch (0.48 mm) thick.
- B. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
  - 1. Stainless Steel: 0.019 inch (0.48 mm) thick.
- C. Flashing Receivers: Fabricate from the following materials:
  - 1. Stainless Steel: 0.016 inch (0.40 mm) thick.
- D. Roof-Penetration Flashing: Fabricate from the following materials:
  - 1. Stainless Steel: 0.019 inch (0.48 mm) thick.
- E. Roof-Drain Flashing: Fabricate from the following materials:
  - 1. Stainless Steel: 0.016 inch (0.40 mm) thick.

## 2.8 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing: Fabricate from the following materials:
  - 1. Stainless Steel: 0.019 inch (0.48 mm) thick.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
  - 1. Verify compliance with requirements for installation tolerances of substrates.
  - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
  - 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 UNDERLAYMENT INSTALLATION

- A. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches (150 mm) staggered 24 inches (600 mm) between courses. Overlap side edges not less than 3-1/2 inches (90 mm). Roll laps and edges with roller. Cover underlayment within 14 days.
- B. Apply slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.

### 3.3 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, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
  - 1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
  - 2. 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.
  - 3. Space cleats not more than 12 inches (300 mm) apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
  - 4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
  - 5. Torch cutting of sheet metal flashing and trim is not permitted.
  - 6. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
  - 1. Coat concealed side of uncoated-aluminum and stainless-steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
  - 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet (3 m) with no joints within 24 inches (600 mm) of corner or intersection.
  - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with sealant concealed within joints.

2. Use lapped expansion joints only where indicated on Drawings.
- D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 3/4 inch (19 mm) for wood screws.
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
  1. Use sealant-filled joints unless otherwise indicated. 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 between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement each 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 Section 079200 "Joint Sealants."
- G. Rivets: Rivet joints where necessary for strength.

### 3.4 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches (100 mm) over base flashing. Install stainless-steel draw band and tighten.
- C. 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 minimum of 4 inches (100 mm). Secure in waterproof manner by means of interlocking folded seam or blind rivets and sealant unless otherwise indicated.
- D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric sealant and clamp flashing to pipes that penetrate roof.



### 3.5 MISCELLANEOUS FLASHING INSTALLATION

- A. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

### 3.6 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) on slope and location lines indicated on Drawings and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

### 3.7 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean off excess sealants.
- C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in 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 076200

## SECTION 077200 - ROOF ACCESSORIES

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

## A. Section Includes:

1. Roof curbs.
2. Equipment supports.
3. Roof hatches.
4. Pipe and duct supports.
5. Pipe portals.

## B. Related Sections:

1. Section 055000 "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.
2. Section 055213 "Pipe and Tube Railings" for safety railing systems not attached to roof-hatch curbs.
3. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.

## 1.3 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

## 1.4 ACTION SUBMITTALS

## A. Product Data: For each type of roof accessory.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

- B. Shop Drawings: For roof accessories.
  - 1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.
- C. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
  - 1. Size and location of roof accessories specified in this Section.
  - 2. Method of attaching roof accessories to roof or building structure.
  - 3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
  - 4. Required clearances.
- B. Sample Warranties: For manufacturer's special warranties.

## 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

## 1.7 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Wind-Restraint Performance: As indicated on Drawings.

### 2.2 ROOF CURBS

- A. Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings, bearing continuously on roof structure, and capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, straight sides, and integrally formed deck-mounting flange at perimeter bottom.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Curbs Plus, Inc.
    - b. Custom Solution Roof and Metal Products.
    - c. Greenheck Fan Corporation.
    - d. Milcor; Commercial Products Group of Hart & Cooley, Inc.
    - e. Roof Curb Systems.
    - f. Roof Products and Systems (RPS); a division of Hart & Cooley, Inc.
- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
- C. Supported Load Capacity: As indicated on Drawings.
- D. Material: Zinc-coated (galvanized) steel sheet, 0.052 inch (1.32 mm) thick.
  - 1. Finish: Mill phosphatized.
- E. Construction:
  - 1. Curb Profile: Manufacturer's standard compatible with roofing system.
  - 2. Fabricate curbs to minimum height of 12 inches (305 mm) above roofing surface unless otherwise indicated.
  - 3. Top Surface: Level top of curb, with roof slope accommodated by sloping deck-mounting flange or by use of leveler frame.
  - 4. Insulation: Factory insulated with 1-1/2-inch- (38-mm-) thick glass-fiber board insulation.
  - 5. Liner: Same material as curb, of manufacturer's standard thickness and finish.

6. Nailer: Factory-installed wood nailer along top flange of curb, continuous around curb perimeter.
7. Platform Cap: Where portion of roof curb is not covered by equipment, provide weathertight platform cap formed from 3/4-inch (19-mm) thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
8. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as curb.
9. Security Grille: Provide where indicated.
10. Damper Tray: Provide damper tray or shelf as indicated on Project Documents.

## 2.3 EQUIPMENT SUPPORTS

- A. Equipment Supports: Rail-type metal equipment supports capable of supporting superimposed live and dead loads between structural supports, including equipment loads and other construction indicated on Drawings, spanning between structural supports; capable of meeting performance requirements; with welded corner joints, integral metal cant, and integrally formed structure-mounting flange at bottom.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Curbs Plus, Inc.
    - b. Custom Solution Roof and Metal Products.
    - c. Greenheck Fan Corporation.
    - d. Milcor; Commercial Products Group of Hart & Cooley, Inc.
    - e. Roof Curb Systems.
    - f. Roof Products and Systems (RPS); a division of Hart & Cooley, Inc.
- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
- C. Material: Zinc-coated (galvanized) steel sheet, 0.052 inch (1.32 mm) thick.
  1. Finish: Mill phosphatized.
- D. Construction:
  1. Curb Profile: Manufacturer's standard compatible with roofing system.
  2. Insulation: Factory insulated with 1-1/2-inch- (38-mm-) thick glass-fiber board insulation.
  3. Liner: Same material as equipment support, of manufacturer's standard thickness and finish.
  4. Nailer: Factory-installed continuous wood nailers 5-1/2 inches (140 mm) wide under top flange on side of curb, continuous around support perimeter.
  5. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.
  6. Fabricate equipment supports to minimum height of 12 inches (305 mm) above roofing surface unless otherwise indicated.

## 2.4 ROOF HATCH

- A. Roof Hatches: Metal roof-hatch units with lids and insulated double-walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, straight sides, and integrally formed deck-mounting flange at perimeter bottom.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Babcock-Davis; Personnel Roof Hatch (BRHP).
    - b. Bilco Company (The); TYPE S.
    - c. JL Industries, Inc.; a division of the Activar Construction Products Group; RHG.
    - d. Milcor; Commercial Products Group of Hart & Cooley, Inc.; M-1.
- B. Type and Size: Single-leaf lid, 48 by 84 inches (750 by 900 mm); unless otherwise noted in Drawings.
- C. Loads: Minimum 40-lbf/sq. ft. (1.9-kPa) external live load and 20-lbf/sq. ft. (0.95-kPa) internal uplift load.
- D. Hatch Material: Zinc-coated (galvanized) steel sheet.
  - 1. Thickness: Minimum 0.079 inch (2.01 mm).
  - 2. Finish: Factory prime coating.
- E. Construction:
  - 1. Insulation: Board Insulation.
    - a. R-Value: 12.0 according to ASTM C 1363.
  - 2. Nailer: Factory-installed wood nailer continuous around hatch perimeter.
  - 3. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
  - 4. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
  - 5. Fabricate curbs to minimum height of 12 inches (305 mm) above roofing surface unless otherwise indicated.
- F. Hardware: Spring operators, hold-open arm, galvanized-steel spring latch with turn handles, galvanized-steel butt- or pintle-type hinge system, and padlock hasps inside and outside.
- G. Ladder-Assist Post: Roof-hatch manufacturer's standard device for attachment to roof-access ladder.
  - 1. Operation: Post locks in place on full extension; release mechanism returns post to closed position.
  - 2. Height: 42 inches (1060 mm) above finished roof deck.
  - 3. Material: Steel tube.
  - 4. Post: 1-5/8-inch- (41-mm-) pipe.

5. Finish: Manufacturer's standard baked enamel or powder coat.
  - a. Color: Safety Yellow.

## 2.5 PIPE AND DUCT SUPPORTS

- A. Fixed-Height Cradle-Type Pipe Supports: Polycarbonate pipe stand accommodating up to 1-1/2-inch- (38-mm-) diameter pipe or conduit; with provision for pipe retainer and with manufacturer's support pad or deck plate as recommended for penetration-free installation over roof membrane type; as required for quantity of pipe runs and sizes.

## 2.6 PIPE PORTALS

- A. Curb-Mounted Pipe Portal: Insulated roof-curb units with welded or mechanically fastened and sealed corner joints, straight sides, and integrally formed deck-mounting flange at perimeter bottom; with weathertight curb cover with single or multiple collared openings and pressure-sealed conically shaped EPDM protective rubber caps sized for piping indicated, with stainless-steel snaplock swivel clamps.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Portals Plus; a division of Hart & Cooley, Inc.
    - b. Roof Products and Systems (RPS); a division of Hart & Cooley, Inc.
- B. Flashing Pipe Portal: Formed aluminum membrane-mounting flashing flange and sleeve with collared opening and pressure-sealed conically shaped EPDM protective rubber cap sized for piping indicated, with stainless-steel snaplock swivel clamps.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Portals Plus; a division of Hart & Cooley, Inc.
    - b. Roof Products and Systems (RPS); a division of Hart & Cooley, Inc.

## 2.7 METAL MATERIALS

- A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 (Z275) coating designation.
  1. Factory Prime Coating: Where field painting is indicated, apply 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).
  2. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils (0.05 mm).

3. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil (0.013 mm).
- B. Aluminum Sheet: ASTM B 209 (ASTM B 209M), manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
  1. Mill Finish: As manufactured.
- C. Aluminum Extrusions and Tubes: ASTM B 221 (ASTM B 221M), manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.
- D. Steel Shapes: ASTM A 36/A 36M, hot-dip galvanized according to ASTM A 123/A 123M unless otherwise indicated.
- E. Steel Tube: ASTM A 500/A 500M, round tube.
- F. Galvanized-Steel Tube: ASTM A 500/A 500M, round tube, hot-dip galvanized according to ASTM A 123/A 123M.
- G. Steel Pipe: ASTM A 53/A 53M, galvanized.

## 2.8 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Cellulosic-Fiber Board Insulation: ASTM C 208, Type II, Grade 1, thickness as indicated.
- C. Glass-Fiber Board Insulation: ASTM C 726, nominal density of 3 lb/cu. ft. (48 kg/cu. m), thermal resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F (29.8 K x m/W at 24 deg C), thickness as indicated.
- D. Polyisocyanurate Board Insulation: ASTM C 1289, thickness and thermal resistivity as indicated.
- E. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWWA C2; not less than 1-1/2 inches (38 mm) thick.
- F. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- G. Underlayment:
  1. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
  2. Polyethylene Sheet: 6-mil- (0.15-mm-) thick polyethylene sheet complying with ASTM D 4397.



3. Slip Sheet: Building paper, 3 lb/100 sq. ft. (0.16 kg/sq. m) minimum, rosin sized.
  4. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
  5. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
  6. Fasteners for Zinc-Coated: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.
  7. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
- H. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.
- I. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.
- J. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.
- K. Asphalt Roofing Cement: ASTM D 4586/D 4586M, asbestos free, of consistency required for application.

## 2.9 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining 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 the Work.
- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Verify dimensions of roof openings for roof accessories.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General: Install roof accessories according to manufacturer's written instructions.
  - 1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
  - 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
  - 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
  - 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
  - 1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
  - 2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
  - 3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.
- C. Roof Curb Installation: Install each roof curb so top surface is level.
- D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.
- E. Roof-Hatch Installation:
  - 1. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
  - 2. Attach ladder-assist post according to manufacturer's written instructions.
- F. Pipe Support Installation: Comply with MSS SP-58 and MSS SP-89. Install supports and attachments as required to properly support piping. Arrange for grouping of parallel runs of horizontal piping, and support together.
  - 1. Pipes of Various Sizes: Space supports for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
- G. Flashing Pipe Portal Installation: Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions; flash sleeve flange to surrounding roof membrane according to roof membrane manufacturer's instructions.
- H. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

### 3.3 REPAIR AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780/A 780M.
- B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 099113 "Exterior Painting."
- C. Clean exposed surfaces according to manufacturer's written instructions.
- D. Clean off excess sealants.
- E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

## SECTION 078100 - APPLIED FIREPROOFING

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section includes sprayed fire-resistive materials.

## 1.3 DEFINITIONS

- A. SFRM: Sprayed fire-resistive materials.

## 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review products, design ratings, restrained and unrestrained conditions, densities, thicknesses, bond strengths, and other performance requirements.

## 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Framing plans or schedules, or both, indicating the following:
  - 1. Extent of fireproofing for each construction and fire-resistance rating.
  - 2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
  - 3. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
  - 4. Treatment of fireproofing after application.
- C. Samples: For each exposed product and for each color and texture specified, 4 inches (102 mm) square in size.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and testing agency.

- B. Product Certificates: For each type of fireproofing.
- C. Evaluation Reports: For fireproofing, from ICC-ES.
- D. Preconstruction Test Reports: For fireproofing.
- E. Field quality-control reports.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.

## 1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 44 deg F (7 deg C) or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.
- B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.
- B. Source Limitations: Obtain fireproofing for each fire-resistance design from single source.
- C. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Steel members are to be considered unrestrained unless specifically noted otherwise.
- D. Asbestos: Provide products containing no detectable asbestos.

## 2.2 SPRAYED FIRE-RESISTIVE MATERIALS

- A. Sprayed Fire-Resistive Material: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Carboline Company; a subsidiary of RPM International; SOUTHWEST TYPE 5GP.
  - b. Grace Construction Products; W.R. Grace & Co. -- Conn.; Grace Construction Products; Monokote MK-6 Series.
  - c. Isolatek International; Cafco 300.
2. Application: Designated for exterior use by a qualified testing agency acceptable to authorities having jurisdiction.
3. Bond Strength: Minimum 150-lbf/sq. ft. (7.18-kPa) cohesive and adhesive strength based on field testing according to ASTM E 736.
4. Density: Not less than density specified in the approved fire-resistance design, according to ASTM E 605.
5. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design or ASTM E 605, whichever is thicker, but not less than 0.375 inch (9 mm).
6. Combustion Characteristics: ASTM E 136. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - a. Flame-Spread Index: 0.
  - b. Smoke-Developed Index: 0.
7. Compressive Strength: Minimum 750 lbf/sq. in. (35.9 kPa) according to ASTM E 761.
8. Corrosion Resistance: No evidence of corrosion according to ASTM E 937.
9. Deflection: No cracking, spalling, or delamination according to ASTM E 759.
10. Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
11. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. (0.270 g/sq. m) in 24 hours according to ASTM E 859.
12. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G 21.
13. Finish: As selected by Architect from manufacturer's standard finishes.
  - a. Color: As selected by Architect from manufacturer's full range.

## 2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

- B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with one or both of the following requirements:
  - 1. Primer and substrate are identical to those tested in required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
  - 2. Primer's bond strength in required fire-resistance design complies with specified bond strength for fireproofing and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests according to ASTM E 736.
- C. Bonding Agent: Product approved by fireproofing manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.
- D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required, according to fire-resistance designs indicated and fireproofing manufacturer's written instructions. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive fireproofing.
- E. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.
- F. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design.
  - 1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
  - 2. Verify that objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
  - 3. Verify that substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.
- B. Verify that concrete work on steel deck is complete before beginning fireproofing work.

- C. Verify that roof construction, installation of rooftop HVAC equipment, and other related work are complete before beginning fireproofing work.
- D. Conduct tests according to fireproofing manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.
- E. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.
- B. Clean substrates of substances that could impair bond of fireproofing.
- C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.
- D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

### 3.3 APPLICATION

- A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fireproofing work.
- B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.
- C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.
  - 1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
  - 2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.
- D. Metal Decks:



1. Do not apply fireproofing to underside of metal deck substrates until concrete topping, if any, is completed.
  2. Do not apply fireproofing to underside of metal roof deck until roofing is completed; prohibit roof traffic during application and drying of fireproofing.
- E. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.
- F. Spray apply fireproofing to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.
- G. Extend fireproofing in full thickness over entire area of each substrate to be protected.
- H. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.
- I. For applications over encapsulant materials, including lockdown (post-removal) encapsulants, apply fireproofing that differs in color from that of encapsulant over which it is applied.
- J. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.
- K. Cure fireproofing according to fireproofing manufacturer's written instructions.
- L. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.
- M. Finishes: Where indicated, apply fireproofing to produce the following finishes:
1. Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected.

### 3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
1. Test and inspect as required by the IBC, Subsection 1705.13, "Sprayed Fire-Resistant Materials."
- B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

- C. Fireproofing will be considered defective if it does not pass tests and inspections.
  - 1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
  - 2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.
- D. Prepare test and inspection reports.

### 3.5 CLEANING, PROTECTING, AND REPAIRING

- A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.
- B. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing is without damage or deterioration at time of Substantial Completion.
- C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.
- D. Repair fireproofing damaged by other work before concealing it with other construction.
- E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 078100

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## SECTION 078123 - INTUMESCENT FIREPROOFING

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section includes mastic and intumescent fire-resistive coatings.
- B. Related Requirements:
  - 1. Section 078100 "Applied Fireproofing" for sprayed fire-resistive materials (SFRM).
  - 2. Section 099646 "Intumescent Painting" for intumescent paints that are fire retarding, but not fire resistive.

## 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review products, design ratings, restrained and unrestrained conditions, thicknesses, and other performance requirements.

## 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Framing plans or schedules, or both, indicating the following:
  - 1. Extent of fireproofing for each construction and fire-resistance rating.
  - 2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
  - 3. Minimum fireproofing thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
  - 4. Treatment of fireproofing after application.
- C. Samples: For each exposed product and for each color and texture specified, **4 inches (102 mm)** square in size.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and testing agency.
- B. Product Certificates: For each type of fireproofing.
- C. Evaluation Reports: For fireproofing, from ICC-ES.
- D. Field quality-control reports.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by fireproofing manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and to set quality standards for materials and execution.
  - 1. Build mockup of each type of fireproofing and different substrate and each required finish as shown on Drawings.
  - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply fireproofing when ambient or substrate temperature is 50 deg F (10 deg C) or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.
- B. Ventilation: Ventilate building spaces during and after application of fireproofing, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fireproofing dries thoroughly.

# PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Assemblies: Provide fireproofing, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.
- B. Source Limitations: Obtain fireproofing for each fire-resistance design from single source.

- C. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Steel members are to be considered unrestrained unless specifically noted otherwise.
- D. Asbestos: Provide products containing no detectable asbestos.

## 2.2 MASTIC AND INTUMESCENT FIRE-RESISTIVE COATINGS

- A. Mastic and Intumescent Fire-Resistive Coating: Manufacturer's standard, factory-mixed formulation] [or] [factory-mixed, multicomponent system consisting of intumescent base coat and topcoat], and complying with indicated fire-resistance design.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Bayseal.
    - b. Hilti, Inc.
    - c. Isolatek International.
  - 2. Application: Designated for "interior general purpose" and "conditioned interior space purpose" use by a qualified testing agency acceptable to authorities having jurisdiction.
  - 3. Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design.
  - 4. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
    - a. Flame-Spread Index: 25 or less.
    - b. Smoke-Developed Index: 50 or less.
  - 5. Hardness: Not less than 80, Type D durometer, according to ASTM D 2240.
  - 6. Finish: As selected by Architect from manufacturer's standard finishes.
    - a. Color and Gloss: As selected by Architect from manufacturer's full range.

## 2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that are compatible with fireproofing and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
- B. Substrate Primers: Primers approved by fireproofing manufacturer and complying with required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

- C. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by fireproofing manufacturer.
- D. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by fireproofing manufacturer. Include pins and attachment.
- E. Topcoat: Suitable for application over applied fireproofing; of type recommended in writing by fireproofing manufacturer for each fire-resistance design.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design.
  - 1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fireproofing with substrates under conditions of normal use or fire exposure.
  - 2. Verify that objects penetrating fireproofing, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
  - 3. Verify that substrates receiving fireproofing are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fireproofing application.
- B. Conduct tests according to fireproofing manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Cover other work subject to damage from fallout or overspray of fireproofing materials during application.
- B. Clean substrates of substances that could impair bond of fireproofing.
- C. Prime substrates where included in fire-resistance design and where recommended in writing by fireproofing manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fireproofing.

- D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fireproofing. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

### 3.3 APPLICATION

- A. Construct fireproofing assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, topcoats, finishing, and other materials and procedures affecting fireproofing work.
- B. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fireproofing; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.
- C. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.
  - 1. Do not begin applying fireproofing until clips, hangers, supports, sleeves, and other items penetrating fireproofing are in place.
  - 2. Defer installing ducts, piping, and other items that would interfere with applying fireproofing until application of fireproofing is completed.
- D. Install auxiliary materials as required, as detailed, and according to fire-resistance design and fireproofing manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by fireproofing manufacturer.
- E. Spray apply fireproofing to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.
- F. Extend fireproofing in full thickness over entire area of each substrate to be protected.
- G. Install body of fireproofing in a single course unless otherwise recommended in writing by fireproofing manufacturer.
- H. Provide a uniform finish complying with description indicated for each type of fireproofing material and matching finish approved for required mockups.
- I. Cure fireproofing according to fireproofing manufacturer's written instructions.
- J. Do not install enclosing or concealing construction until after fireproofing has been applied, inspected, and tested and corrections have been made to deficient applications.
- K. Finishes: Where indicated, apply fireproofing to produce the following finishes:



1. Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected.
2. Spray-Textured Finish: Finish left as spray applied with no further treatment.
3. Rolled, Spray-Textured Finish: Even finish produced by rolling spray-applied finish with a damp paint roller to remove drippings and excessive roughness.

### 3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
  1. Test and inspect as required by the IBC[, Subsection 1705.14, "Mastic and Intumescent Fire-Resistant Coatings." and as indicated on Schedule of Special Inspections.
- B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fireproofing for the next area until test results for previously completed applications of fireproofing show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.
- C. Fireproofing will be considered defective if it does not pass tests and inspections.
  1. Remove and replace fireproofing that does not pass tests and inspections, and retest.
  2. Apply additional fireproofing, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.
- D. Prepare test and inspection reports.

### 3.5 CLEANING, PROTECTING, AND REPAIRING

- A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.
- B. Protect fireproofing, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fireproofing is without damage or deterioration at time of Substantial Completion.
- C. As installation of other construction proceeds, inspect fireproofing and repair damaged areas and fireproofing removed due to work of other trades.
- D. Repair fireproofing damaged by other work before concealing it with other construction.
- E. Repair fireproofing by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 078123

## SECTION 078413 - PENETRATION FIRESTOPPING

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section Includes:

- 1. Penetrations in fire-resistance-rated walls.
  - 2. Penetrations in horizontal assemblies.
  - 3. Penetrations in smoke barriers.

- B. Related Requirements:

- 1. Section 078443 "Joint Firestopping" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

## 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

## 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.
  - 1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved and stamped by a fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

- B. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

## 1.6 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."

## 1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

## 1.9 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
  - 1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
  - 2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:

- a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.
  - 1) UL in its "Fire Resistance Directory."

## 2.2 PENETRATION FIRESTOPPING SYSTEMS

- A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. 3M Fire Protection Products.
    - b. Hilti, Inc.
    - c. NUCO Inc.
    - d. RectorSeal.
    - e. Tremco, Inc.
- B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
  - 1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
  - 1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
  - 2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
  - 3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.
- D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg (74.7 Pa).
  - 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. (0.025 cu. m/s per sq. m) of penetration opening at and no more than 50-cfm (0.024-cu. m/s) cumulative total for any 100 sq. ft. (9.3 sq. m) at both ambient and elevated temperatures.
- E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.

- F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.
1. Permanent forming/damming/backing materials.
  2. Substrate primers.
  3. Collars.
  4. Steel sleeves.

## 2.3 FILL MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- G. 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.
- H. 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. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

## 2.4 MIXING

- A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping 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 the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with 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 penetration firestopping materials.
  - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
  - 3. Remove laitance and form-release agents from concrete.
- B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

### 3.3 INSTALLATION

- A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.
- B. Install forming 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.
  - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.

C. Install fill materials by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
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 the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

### 3.4 IDENTIFICATION

A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches (76 mm) high and with minimum 0.375-inch (9.5-mm) strokes.

1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet (4.57 m) from end of wall and at intervals not exceeding 30 feet (9.14 m).

B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing and inspecting agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

### 3.5 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2174.
- B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.
- C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

### 3.6 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping 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 penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

### 3.7 PENETRATION FIRESTOPPING SYSTEM SCHEDULE

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.
- B. Penetration Firestopping Systems with No Penetrating Items: As indicated on Drawings.
- C. Penetration Firestopping Systems for Metallic Pipes, Conduit, or Tubing: As indicated on Drawings.
- D. Penetration Firestopping Systems for Nonmetallic Pipe, Conduit, or Tubing: As indicated on Drawings.
- E. Penetration Firestopping Systems for Electrical Cables: As indicated on Drawings.
- F. Penetration Firestopping Systems for Cable Trays with Electric Cables: As indicated on Drawings.
- G. Penetration Firestopping Systems for Insulated Pipes: As indicated on Drawings.
- H. Penetration Firestopping Systems for Miscellaneous Electrical Penetrants: As indicated on Drawings.
- I. Penetration Firestopping Systems for Miscellaneous Mechanical Penetrants: As indicated on Drawings.
- J. Penetration Firestopping Systems for Groupings of Penetrants: As indicated on Drawings.

END OF SECTION 078413



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## SECTION 078443 - JOINT FIRESTOPPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Joints in or between fire-resistance-rated constructions.
  - 2. Joints at exterior curtain-wall/floor intersections.
  - 3. Joints in smoke barriers.

- B. Related Requirements:

- 1. Section 078413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, smoke barriers, and for wall identification.
  - 2. Section 092216 "Non-Structural Metal Framing" for firestop tracks for metal-framed partition heads.

#### 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.
  - 1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved and stamped by fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

- B. Product Test Reports: For each joint firestopping system, for tests performed by a qualified testing agency.

## 1.6 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

## 1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

## 1.9 COORDINATION

- A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of joints to accommodate joint firestopping systems.

# PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
  - 1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
  - 2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
    - a. Joint firestopping systems shall bear classification marking of a qualified testing agency.
      - 1) UL in its "Fire Resistance Directory."

## 2.2 JOINT FIRESTOPPING SYSTEMS

- A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
- B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E 1966 or UL 2079.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. 3M Fire Protection Products.
    - b. BlazeFrame Industries.
    - c. Hilti, Inc.
    - d. NUCO Inc.
    - e. RectorSeal.
    - f. Roxul Inc.
    - g. Thermafiber, Inc.; an Owens Corning company.
    - h. Tremco, Inc.
  - 2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.
- C. Joints at Exterior Curtain-Wall/Floor Intersections: Provide joint firestopping systems with rating determined per ASTM E 2307.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. 3M Fire Protection Products.
    - b. Hilti, Inc.
    - c. NUCO Inc.
    - d. RectorSeal.
    - e. Roxul Inc.
    - f. Thermafiber, Inc.; an Owens Corning company.
    - g. Tremco, Inc.
  - 2. F-Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.
- D. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg (74.7 Pa).
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. 3M Fire Protection Products.
    - b. Hilti, Inc.

- c. NUCO Inc.
  - d. RectorSeal.
  - e. Roxul Inc.
  - f. Thermafiber, Inc.; an Owens Corning company.
  - g. Tremco, Inc.
2. L-Rating: Not exceeding 5.0 cfm/ft. (0.00775 cu. m/s x m) of joint at both ambient and elevated temperatures.
- E. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- F. Accessories: Provide components of fire-resistive joint systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Surface Cleaning: Before installing fire-resistive joint systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
  - 1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
  - 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
  - 3. Remove laitance and form-release agents from concrete.
- B. Prime substrates where recommended in writing by joint firestopping 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.

#### 3.3 INSTALLATION

- A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

- B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
  - 1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.
- C. Install elastomeric fill materials for fire-resistive joint systems by proven techniques to produce the following results:
  - 1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
  - 2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
  - 3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

### 3.4 IDENTIFICATION

- A. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
  - 1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
  - 2. Contractor's name, address, and phone number.
  - 3. Designation of applicable testing agency.
  - 4. Date of installation.
  - 5. Manufacturer's name.
  - 6. Installer's name.

### 3.5 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2393.
- B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.
- C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

### 3.6 CLEANING AND PROTECTION

- A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.
- B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

### 3.7 JOINT FIRESTOPPING SYSTEM SCHEDULE

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHBN or Category XHDG.
- B. Floor-to-Floor, Joint Firestopping Systems: As indicated on Drawings.
- C. Wall-to-Wall, Joint Firestopping Systems: As indicated on Drawings.
- D. Floor-to-Wall, Joint Firestopping Systems: As indicated on Drawings.
- E. Head-of-Wall, Fire-Resistive Joint Firestopping Systems: As indicated on Drawings.
- F. Bottom-of-Wall, Joint Firestopping Systems: As indicated on Drawings.
- G. Wall-to-Wall, Joint Firestopping Systems Intended for Use as Corner Guards: As indicated on Drawings.
- H. Perimeter Joint Firestopping Systems: As indicated on Drawings.

END OF SECTION 078443

## SECTION 079200 - JOINT SEALANTS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section Includes:

- 1. Silicone joint sealants.
  - 2. Nonstaining silicone joint sealants.
  - 3. Urethane joint sealants.
  - 4. Mildew-resistant joint sealants.
  - 5. Butyl joint sealants.
  - 6. Latex joint sealants.

- B. Related Requirements:

- 1. Section 079100 "Preformed Joint Seals" for preformed compressible foam and precured joint seals.

## 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

## 1.4 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- 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 kind 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. Joint-Sealant Schedule: Include the following information:
  - 1. Joint-sealant application, joint location, and designation.
  - 2. Joint-sealant manufacturer and product name.



3. Joint-sealant formulation.
4. Joint-sealant color.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Product Test Reports: For each kind of joint sealant, for tests performed by a qualified testing agency.
- C. Field-Adhesion-Test Reports: For each sealant application tested.
- D. Sample Warranties: For special warranties.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Product Testing: Test joint sealants using a qualified testing agency.
  1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.
- C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

## 1.7 FIELD 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. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

## 1.8 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  1. Warranty Period: Five years from date of Substantial Completion.

- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
  - 1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
  - 2. Disintegration of joint substrates from 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 JOINT SEALANTS, 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 joint-sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: Match Architect's samples; unless otherwise noted.

### 2.2 SILICONE JOINT SEALANTS

- A. Silicone, S, NS, 100/50, T, NT: Single-component, nonsag, plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Uses T and NT.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Dow Corning Corporation; DOW CORNING® NS PARKING STRUCTURE SEALANT.
    - b. Pecora Corporation; **311 NS**.
    - c. Tremco Incorporated; Spectrem 800.

### 2.3 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.
- B. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Dow Corning Corporation; Dow Corning® 795 Silicone Building Sealant.
  - b. Pecora Corporation; Pecora 864NST.
  - c. Tremco Incorporated; Spectrem 3.

## 2.4 URETHANE JOINT SEALANTS

- A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. BASF Corporation-Construction Systems; MasterSeal CR 195.
    - b. Pecora Corporation; Dynatrol I-XL.
    - c. Sherwin-Williams Company (The); Stampede-1.
    - d. Tremco Incorporated; Vulkem 116.
- B. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. BASF Corporation-Construction Systems; MasterSeal SL 1.
    - b. Pecora Corporation; NR-201.
    - c. Sherwin-Williams Company (The); Stampede 1SL.

## 2.5 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Dow Corning Corporation; DOW CORNING® 786 SILICONE SEALANT -.
    - b. Pecora Corporation; Pecora 860.
    - c. Tremco Incorporated; Tremsil 200.

## 2.6 BUTYL JOINT SEALANTS

- A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Bostik, Inc; Chem-Calk 300.
  - b. Pecora Corporation; BC-158.

## 2.7 LATEX JOINT SEALANTS

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Pecora Corporation; AC-20.
  - b. Sherwin-Williams Company (The); 950A Siliconized Acrylic Latex Caulk.
  - c. Tremco Incorporated; Tremflex 834.

## 2.8 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. BASF Corporation-Construction Systems; MasterSeal 920.
  - b. Construction Foam Products; a division of Nomaco, Inc.; HBR.

- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. 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. Provide self-adhesive tape where applicable.

## 2.9 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 performance of the Work.
- 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, 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. Exterior insulation and finish systems.
    - e. Direct applied exterior finish systems.
  - 3. Remove laitance and form-release agents from concrete.
  - 4. Clean nonporous joint substrate 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.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by 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 or primer 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. Install sealant backings of kind 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.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. 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.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs 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 profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
  - 4. Provide flush joint profile at locations indicated on Drawings according to Figure 8B in ASTM C 1193.
  - 5. Provide recessed joint configuration of recess depth and at locations indicated on Drawings according to Figure 8C in ASTM C 1193.
    - a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

### 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 and cured sealant joints as follows:
  - a. Perform 10 tests for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
  - b. Perform one test for each 1000 feet (300 m) of joint length thereafter or one test per each floor per elevation.
2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
  - a. 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.
3. 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 material, sealant configuration, and sealant dimensions.
4. 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-Adhesion-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, remove, and repair 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: Exterior joints in horizontal traffic surfaces.
  - 1. Joint Locations:
    - a. Construction joints in cast-in-place concrete.
    - b. Other joints as indicated on Drawings.
  - 2. Joint Sealant: Silicone, S, NS, 100/50, T, NT.
  - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces subject to water immersion.
  - 1. Joint Locations:
    - a. Joints in pedestrian plazas.
    - b. Other joints as indicated on Drawings.
  - 2. Joint Sealant: Urethane, immersible, S, P, 25, T, NT, I.
  - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
  - 1. Joint Locations:
    - a. Construction joints in cast-in-place concrete.
    - b. Control and expansion joints in unit masonry.
    - c. Joints in exterior insulation and finish systems.
    - d. Joints between metal panels.
    - e. Joints between different materials listed above.
    - f. Perimeter joints between materials listed above and frames of doors, windows, and louvers.
    - g. Control and expansion joints in ceilings and other overhead surfaces.
    - h. Other joints as indicated on Drawings.
  - 2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
  - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- D. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
  - 1. Joint Locations:
    - a. Isolation joints in cast-in-place concrete slabs.
    - b. Control and expansion joints in stone flooring.
    - c. Control and expansion joints in tile flooring.
    - d. Other joints as indicated on Drawings.



2. Joint Sealant: Urethane, S, P, 25, T, NT.
  3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
    - a. Control and expansion joints on exposed interior surfaces of exterior walls.
    - b. Tile control and expansion joints.
    - c. Vertical joints on exposed surfaces of **unit masonry** walls and partitions.
    - d. Other joints as indicated on Drawings.
  2. Joint Sealant: Urethane, S, NS, 25, NT.
  3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- F. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.
1. Joint Locations:
    - a. Control joints on exposed interior surfaces of exterior walls.
    - b. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
    - c. Other joints as indicated on Drawings.
  2. Joint Sealant: Acrylic latex.
  3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- G. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
1. Joint Locations:
    - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    - b. Other joints as indicated on Drawings.
  2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
  3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- H. Joint-Sealant Application: Concealed mastics.
1. Joint Locations:
    - a. Aluminum thresholds.
    - b. Sill plates.
    - c. Other joints as indicated on Drawings.

2. Joint Sealant: Butyl-rubber based.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 079200

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## SECTION 079219 - ACOUSTICAL JOINT SEALANTS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section includes acoustical joint sealants.
- B. Related Requirements:
  - 1. Section 079200 "Joint Sealants" for elastomeric, latex, and butyl-rubber-based joint sealants for nonacoustical applications.

## 1.3 ACTION SUBMITTALS

- A. Product Data: For each acoustical joint sealant.
- 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 kind and color of acoustical 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. Acoustical-Joint-Sealant Schedule: Include the following information:
  - 1. Joint-sealant application, joint location, and designation.
  - 2. Joint-sealant manufacturer and product name.
  - 3. Joint-sealant formulation.
  - 4. Joint-sealant color.

## 1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each kind of acoustical joint sealant, for tests performed by a qualified testing agency.
- B. Sample Warranties: For special warranties.

## 1.5 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace acoustical joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Provide acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies according to ASTM E 90.

### 2.2 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C 834.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Franklin International; Titebond GREENchoice Professional Acoustical Smoke & Sound Sealant.
  - b. Hilti, Inc.; CP 506 Smoke and Acoustical Sealant.
  - c. Pecora Corporation; AC-20 FTR.
2. Colors of Exposed Acoustical Joint Sealants: As selected by Architect from manufacturer's full range of colors; unless otherwise noted as custom color.

### 2.3 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by acoustical-joint-sealant manufacturer where required for adhesion of sealant to joint substrates.
- 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 acoustical joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- 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 acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where recommended by acoustical-joint-sealant manufacturer. 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 or primer 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 ACOUSTICAL JOINT SEALANTS

- A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.
- B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C 919, ASTM C 1193, and manufacturer's written recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.
- C. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

### 3.4 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 acoustical joint sealants and of products in which joints occur.

### 3.5 PROTECTION

- A. Protect acoustical 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, remove, and repair damaged or deteriorated acoustical joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 079219

## SECTION 081113 - HOLLOW METAL 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 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section includes hollow-metal work.
- B. Related Requirements:
  - 1. Section 081416 "Flush Wood Doors" for wood doors installed in hollow-metal frames.
  - 2. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.
  - 3. Section 099113 "Exterior Painting" for painting of hollow-metal doors and frames.
  - 4. Section 099123 "Interior Painting" for painting of hollow-metal doors and frames.

## 1.3 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

## 1.4 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

## 1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

## 1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.



B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

C. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

## 1.7 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ceco Door; ASSA ABLOY.
  2. Curries Company; ASSA ABLOY.
  3. Mesker Door Inc.
  4. Steelcraft; an Allegion brand.
- B. Source Limitations: Obtain hollow-metal work from single source, from single manufacturer.

## 2.2 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80, listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
  - 1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

## 2.3 INTERIOR DOORS AND FRAMES

- A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3.
  - 1. Physical Performance: Level A according to SDI A250.4.
  - 2. Doors:
    - a. Type: As indicated in the Door and Frame Schedule.
    - b. Thickness: 1-3/4 inches (44.5 mm).
    - c. Face: Uncoated, cold-rolled steel sheet, minimum thickness of 0.053 inch (1.3 mm).
    - d. Edge Construction: Model 2, Seamless.
    - e. Core: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core at manufacturer's discretion.
  - 3. Frames:
    - a. Materials: Uncoated, steel sheet, minimum thickness of 0.053 inch (1.3 mm).
    - b. Construction: Full profile welded.
  - 4. Exposed Finish: Prime.

## 2.4 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Extra-Heavy-Duty Doors and Frames: SDI A250.8, Level 3.
  - 1. Physical Performance: Level A according to SDI A250.4.
  - 2. Doors:

- a. Type: As indicated in the Door and Frame Schedule.
- b. Thickness: 1-3/4 inches (44.5 mm.)
- c. Face: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A40 (ZF120) coating.
- d. Edge Construction: Model 2, Seamless.
- e. Core: Polyurethane.

- 1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than 2.1 deg F x h x sq. ft./Btu (0.370 K x sq. m/W) when tested according to ASTM C 1363.

3. Frames:

- a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch (1.3 mm), with minimum A40 (ZF120) coating.
- b. Construction: Full profile welded.

- 1) Provide closure plate in frame header.

4. Exposed Finish: Prime.

## 2.5 FRAME ANCHORS

A. 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 (51 mm) wide by 10 inches (254 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.

## 2.6 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- C. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.
  - 1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- D. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- E. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.

- F. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- G. Bituminous Coating: Cold-applied asphalt mastic, 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.

## 2.7 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. 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. Hollow-Metal Doors:
  - 1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch (0.66 mm), steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches (152 mm) apart. Spot weld to face sheets no more than 5 inches (127 mm) o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
  - 2. Fire Door Cores: As required to provide fire-protection ratings indicated.
  - 3. Vertical Edges for Single-Acting Doors: Bevel edges 1/8 inch in 2 inches (3.2 mm in 51 mm).
  - 4. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.
  - 5. Bottom Edge Closures: Close bottom edges of doors with end closures or channels of same material as face sheets.
  - 6. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
- C. Hollow-Metal 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. Use continuous around frames for exterior frames mounted butting the surface above.
  - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
  - 3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
  - 4. Jamb Anchors: Provide number and spacing of anchors as follows:
    - a. Masonry Type: Locate anchors not more than 16 inches (406 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c., to match coursing, and as follows:

- 1) Two anchors per jamb up to 60 inches (1524 mm) high.
    - 2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
    - 3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
  - 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) high.
    - 2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
    - 3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
    - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
5. Head Anchors: Two anchors per head for frames more than 42 inches (1067 mm) wide and mounted in metal-stud partitions as recommended by manufacturer.
6. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. 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. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
  1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
  2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

## 2.8 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
  1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

## 2.9 ACCESSORIES

- A. Grout Guards: Formed from same material as frames, not less than 0.016 inch (0.4 mm) thick.

## 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 the Work.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

### 3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames for doors and other openings, of size and profile indicated. Comply with SDI A250.11 as required by standards specified.
  - 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-rated openings, install frames according to NFPA 80.
    - b. Where frames are fabricated in sections because of 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 door silencers in frames before grouting.
    - d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    - e. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

- f. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
- 2. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
- 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
- 4. Installation Tolerances: Adjust hollow-metal 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. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
  - 1. Non-Fire-Rated Steel Doors:
    - a. Between Door and Frame Jambs and Head: 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
    - b. Between Edges of Pairs of Doors: 1/8 inch (3.2 mm) to 1/4 inch (6.3 mm) plus or minus 1/32 inch (0.8 mm).
    - c. At Bottom of Door: 3/4 inch (19.1 mm) plus or minus 1/32 inch (0.8 mm).
    - d. Between Door Face and Stop: 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
  - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
  - 3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.

### 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 hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work 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, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION 081113

## SECTION 081416 - FLUSH WOOD DOORS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

## A. Section Includes:

1. Solid-core doors with wood-veneer.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

## B. Related Requirements:

1. Section 0831113 "Hollow Metal Doors And Frames" for hollow metal frames for flush wood doors.

## 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

## 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of door. Include details of core and edge construction and trim for openings. Include factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
  1. Dimensions and locations of blocking.
  2. Dimensions and locations of mortises and holes for hardware.
  3. Dimensions and locations of cutouts.
  4. Undercuts.
  5. Requirements for veneer matching.
  6. Doors to be factory finished and finish requirements.
  7. Fire-protection ratings for fire-rated doors.
- C. Samples for Initial Selection: For factory-finished doors.
- D. Samples for Verification:



1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
2. Corner sections of doors, approximately 8 by 10 inches (200 by 250 mm), with door faces and edges representing actual materials to be used.
  - a. Provide Samples for each species of veneer and solid lumber required.
  - b. Finish veneer-faced door Samples with same materials proposed for factory-finished doors.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.
- B. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

#### 1.6 QUALITY ASSURANCE

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in polyethylene bags and wrap bundles of doors in plastic sheeting.
- C. Mark each door on top rail with opening number used on Shop Drawings.

#### 1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

#### 1.9 WARRANTY

- A. A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
  1. Failures include, but are not limited to, the following:
    - a. Warping (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section.

- b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 76.2-mm) span.
- 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
- 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Algoma Hardwoods, Inc.
  - 2. Marshfield Door Systems, Inc.
  - 3. Mohawk Flush Doors, Inc.
  - 4. Oshkosh Door Company.
  - 5. VT Industries, Inc.
- B. Source Limitations: Obtain flush wood doors from single manufacturer.

### 2.2 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."
  - 1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.
  - 2. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.
- B. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, Category A.
  - 1. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
  - 2. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
  - 3. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
- C. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.
- D. Particleboard-Core Doors:

1. Particleboard: ANSI A208.1, Grade LD-2.
2. Blocking: Provide wood blocking in particleboard-core doors as follows:
  - a. 5-inch (125-mm) top-rail blocking, in doors indicated to have closers to eliminate through bolting of hardware.
  - b. 5-inch (125-mm) bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
  - c. 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.
3. Provide doors with structural-composite-lumber cores instead of particleboard cores for doors with cut-outs exceeding 40 percent or 54 inches (1376.1 mm) of door height.

E. Structural-Composite-Lumber-Core Doors:

1. Structural Composite Lumber: WDMA I.S.10.
  - a. Screw Withdrawal, Face: 700 lbf (3100 N).
  - b. Screw Withdrawal, Edge: 400 lbf (1780 N).

F. Mineral-Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated follows:
  - a. 5-inch (125-mm) top-rail blocking to eliminate through bolting of hardware.
  - b. 5-inch (125-mm) bottom-rail blocking, in doors indicated to have protection plates.
  - c. 5-inch (125-mm) midrail blocking, in doors indicated to have armor plates.
  - d. 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.
3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
  - a. Screw-Holding Capability: 550 lbf (2440 N) per WDMA T.M.-10.

## 2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Custom (Grade A faces).
2. Species: Select white birch.
3. Cut: Plain sliced (flat cut).
4. Match between Veneer Leaves: Book match.
5. Assembly of Veneer Leaves on Door Faces: Running match.

6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
7. Room Match: Provide door faces of compatible color and grain within each separate room or area of building.
8. Exposed Vertical Edges: Same species as faces - edge Type A.
9. Core: Particleboard.
10. Construction: Five plies, hot-pressed. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering, with HDF composite cross-banding.

## 2.4 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
  1. Comply with NFPA 80 requirements for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
  1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
  2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

## 2.5 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
  1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors.
- C. Transparent Finish:
  1. Grade: Custom.
  2. Finish: AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" System 5, conversion varnish or System 11, catalyzed polyurethane.
  3. Staining: As selected by Architect from manufacturer's full range.
  4. Effect: Simulated Filled finish.
  5. Sheen: Satin.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
  - 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
  - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Hardware: For installation, see Section 087100 "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
  - 1. Install fire-rated doors according to NFPA 80.
  - 2. Install smoke- and draft-control doors according to NFPA 105.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
  - 1. Clearances: Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold unless otherwise indicated.
    - a. Comply with NFPA 80 for fire-rated doors.
    - b. Bevel non-fire-rated doors 1/8 inch in 2 inches (3 degrees) at lock and hinge edges.
  - 2. Bevel fire-rated doors 1/8 inch in 2 inches (3 degrees) at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

### 3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.

- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

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## SECTION 08 52 13

## ALUMINUM-CLAD WOOD OUTSWING DOORS

## PART 1 GENERAL

**1.1 SECTION INCLUDES**

- A. Aluminum-clad wood commercial out-swing French hinged doors.

**1.2 RELATED SECTIONS**

- A. Section 07270 (07 27 00) - Air Barriers: Water-resistant barrier.
- B. Section 07920 (07 92 00) - Joint Sealants: Sealants and caulking.
- C. Section 08710 (08 71 00) - Door Hardware.

**1.3 REFERENCES**

- A. American Architectural Manufacturers Association (AAMA):
  - 1. AAMA 502 - Voluntary Specification for Field Testing of Windows and Sliding Doors.
  - 2. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
  - 3. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
- B. American Society for Testing and Materials (ASTM):
  - 1. ASTM B 117 - Operating Salt Spray (Fog) Apparatus.
  - 2. ASTM C 1036 - Flat Glass.
  - 3. ASTM C 1048 - Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated Glass.
  - 4. ASTM D 1149 - Rubber Deterioration – Surface Ozone Cracking in a Chamber.
  - 5. ASTM D 2803 - Filiform Corrosion Resistance of Organic Coatings on Metal.
  - 6. ASTM D 3656 - Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns.
  - 7. ASTM D 4060 - Abrasion Resistance of Organic Coatings by the Taber Abraser.
  - 8. ASTM E 283 - Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Difference Across the Specimen.
  - 9. ASTM E 330 - Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
  - 10. ASTM E 547 - Water Penetration of Exterior Windows, Curtain Walls and Doors by Cyclic Static Air Pressure Differential.
  - 11. ASTM E 1105 – Standard Test Method for Field Determination of Water Penetration of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
  - 12. ASTM G 85 - Modified Salt Spray (Fog) Testing.
- C. Window and Door Manufacturers Association (WDMA):
  - 1. AAMA/WDMA/CSA 101/I.S.2/A440 – North American Fenestration Standard/Specification for windows, doors and skylights
  - 2. WDMA I.S.4 - Industry Specification for Preservative Treatment for Millwork.

**1.4 PERFORMANCE REQUIREMENTS**



- A. Doors not rated due to 0 psf water performance with low profile sill.
- B. Door Unit Air Leakage, ASTM E 283, 1.57 psf (25 mph): 0.15 cfm per square foot of frame or less.

## **1.5 SUBMITTALS**

- A. Comply with Division 1 requirements.
- B. Product Data: Submit manufacturer's product data, including installation instructions.
- C. Shop Drawings: Submit manufacturer's shop drawings, indicating dimensions, construction, component connections and locations, anchorage methods and locations, hardware locations, and installation details.
- D. Samples: Submit full-size or partial full-size sample of door illustrating glazing system, quality of construction, and color of finish.
- E. Warranty: Submit manufacturer's standard warranty.

## **1.6 QUALITY ASSURANCE**

- A. Mockup:
  - 1. Provide sample installation for field testing door performance requirements and to determine acceptability of door installation methods.
  - 2. Approved mockup shall represent minimum quality required for the Work.
  - 3. Approved mockup shall [not] remain in place within the Work.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Delivery: Deliver materials to site undamaged in manufacturer's or sales branch's original, unopened containers and packaging, with labels clearly identifying manufacturer and product name. Include installation instructions.
- B. Storage: Store materials in an upright position, off ground, under cover, and protected from weather, direct sunlight, and construction activities.
- C. Handling: Protect materials and finish during handling and installation to prevent damage.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURER**

- A. Pella Corporation, 102 Main Street, Pella, Iowa 50219. Toll Free (800) 54-PELLA. Phone (641) 621-1000. Website [www.pella.com](http://www.pella.com).

### **2.2 ALUMINUM-CLAD WOOD COMMERCIAL OUT-SWING FRENCH HINGED DOORS**

- A. Aluminum-Clad Wood Commercial Out-Swing French Hinged Doors: Architect Series factory-assembled aluminum-clad wood doors with outward-swing door panels installed in frame.
- B. Frame:
  - 1. Select woods, water-repellent, preservative-treated with EnduraGuard® in accordance with WDMA I.S.-4. EnduraGuard includes water-repellency, three active fungicides and an insecticide applied to the frame.
  - 2. Interior Exposed Surfaces: Pine veneered and edge-banded with no visible fastener holes.

3. Exterior Surfaces: Clad with aluminum at head and jambs.
  4. Metal Sill: Solid aluminum, ADA approved, low profile.
    - a. Finish: Mill finish.
  5. Overall Frame Depth: 5-7/8 inches (149 mm).
- C. Door Panel:
1. Select woods, water-repellent, preservative-treated with EnduraGuard in accordance with WDMA I.S.-4. EnduraGuard includes water-repellency, three active fungicides and an insecticide applied to the panel.
  2. Panels: Three-ply construction. Randomly finger-jointed blocks laminated with water-resistant glue.
  3. Interior Exposed Surfaces: Pine core veneered with [Pine] [Mahogany] [Douglas Fir], with glass stops.
  4. Exterior Surfaces: Clad with aluminum.
  5. Intermediate Bar: 5-1/4 inches high.
  6. Corners: Urethane-sealed and secured with metal fasteners.
  7. Sash Thickness: 2-1/16 inches (52 mm).
- D. Weather Strip:
1. Dual-durometer extruded polymer along jambs, head and sill.
  2. Dual-durometer extruded polymer rainscreen along top and sides of panel.
  3. Bristle rainscreen along bottom of panel.

## 2.3 GLAZING

- A. Glazing:
1. Float Glass: ASTM C 1036, Quality 1.
    - a. Tempered Glass: ASTM C 1048.
  2. Type: Urethane-glazed 13/16-inch, dual-seal, fully tempered, insulating glass, clear multi-layer Low-E coated with argon
  4. Integral Light Technology Glazing and Grilles:
    - a. Insulating glass contains non-glare spacer between the panes of glass.
    - b. Grid: Adhered to glass on double pane and a metal spacer on triple pane.
    - c. Room Side Grilles: 2" wide rectangular profile that are solid Clear Pine.
    - d. Exterior Grilles: Extruded aluminum 2" rectangular profile]. Dimension to match room side grilles.
    - e. Bars shall be adhered to both sides of insulating glass with VHB acrylic adhesive tape and aligned with non-glare grid.
    - f. Finish: Finish color matches interior and exterior finish colors.

## 2.5 HARDWARE

- A. Hinges:
1. Doors 6' 10" and under frame height will have three (3) ball-bearing hinges.
  2. Doors over 6' 10" frame height up to and including 8' 0" frame height will have four (4) ball bearing hinges.
  3. Finish: compliments the finish of the sill.

## 2.6 TOLERANCES

- A. Doors shall accommodate the following opening tolerances:

1. Vertical Dimensions Between High and Low Points: Plus 1/8 inch, minus 0 inch.
2. Width Dimensions: Plus 1/8 inch, minus 0 inch.
3. Building Columns or Masonry Openings: Plus or minus 1/8 inch from plumb.

## **2.7 FINISH**

- A. Exterior Finish System: Pella EnduraClad Plus.
  1. Exterior aluminum surfaces shall be finished with the following multi-stage system:
    - a. Clean and etch aluminum surface of oxides.
    - b. Pre-treat with chrome phosphate conversion coating.
    - c. Pre-treat with chromic acid sealer/rinse.
    - d. Top coat with baked-on 70% fluoropolymer-based enamel.
  2. Color: Black
  3. Performance Requirements: Exterior aluminum finishes shall meet or exceed all performance requirements of AAMA 2605.
- B. Interior Finish: Factory finished with 1 prime coat and 1 top coat of Black.

## **2.8 INSTALLATION ACCESSORIES**

- A. Flashing/Sealant Tape: Pella SmartFlash.
  1. Aluminum-foil-backed butyl window and door flashing tape.
  2. Maximum Total Thickness: 0.013 inch.
  3. UV resistant.
  4. Verify sealant compatibility with sealant manufacturer.
- B. Interior Insulating-Foam Sealant: Low-expansion, low-pressure polyurethane insulating window and door foam sealant.
- C. Exterior Perimeter Sealant: "Pella Window and Door Installation Sealant" or equivalent high quality, multi-purpose sealant as specified in the joints sealant section.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine areas to receive doors. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

### **3.2 INSTALLATION**

- A. Install doors in accordance with manufacturer's instructions and approved shop drawings.
- B. Install doors to be weather-tight and freely operating.
- C. Maintain alignment with adjacent work.
- D. Secure assembly to framed openings, plumb and square, without distortion.
- E. Integrate door system installation with exterior weather-resistant barrier using flashing/sealant tape. Apply and integrate flashing/sealant tape with weather-resistant barrier using watershed principles in accordance with door manufacturer's instructions.

- F. Place interior seal around door perimeter to maintain continuity of building thermal and air barrier using [backer rod and sealant] [insulating-foam sealant].
- G. Seal door to exterior wall cladding with sealant and related backing materials at perimeter of assembly.
- H. Leave doors closed.

### **3.3 FIELD QUALITY CONTROL**

- A. Field Testing: Field water testing shall be conducted in accordance with ASTM E1105 Test Procedure B. The test pressure shall be based on the maximum positive components and cladding design pressure. Utilizing the AAMA 502 field test reduction, the water test pressure is 10% of the maximum positive design pressure.

### **3.4 CLEANING**

- A. Clean door frames and glass in accordance with Division 1 requirements.
- B. Do not use harsh cleaning materials or methods that would damage finish.
- C. Remove labels and visible markings.

### **3.5 PROTECTION**

- A. Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.

**END OF SECTION**



## SECTION 083113 - ACCESS 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 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section includes access doors and frames for walls and ceilings.
- B. Related Requirements:
  - 1. Section 077200 "Roof Accessories" for roof hatches.

## 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches (150 by 150 mm) in size.
- C. Product Schedule: For access doors and frames.
- D. Shop Drawings: For access door and frames.
  - 1. Include plans indicating locations of each access door and frame.

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, according to NFPA 252 or UL 10B.

## 2.2 ACCESS DOORS AND FRAMES

### A. Flush Access Doors with Concealed Flanges:

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Babcock-Davis; BNW.
  - b. JL Industries, Inc.; a division of the Activar Construction Products Group; WB.
  - c. Larsens Manufacturing Company; L-DWC.
  - d. Milcor; Commercial Products Group of Hart & Cooley, Inc.; DW.
  - e. Williams Bros. Corporation of America (The); DW400.
2. Description: Face of door flush with frame; with concealed flange for gypsum board installation and concealed hinge.
3. Locations: Wall and ceiling.
4. Door Size: As specified in Drawings.
5. Uncoated Steel Sheet for Door: Nominal 0.060 inch (1.52 mm), 16 gage, factory primed.
6. Frame Material: Same material and thickness as door.
7. Latch and Lock: Cam latch, screwdriver operated.

## 2.3 FIRE-RATED ACCESS DOORS AND FRAMES

### A. Fire-Rated, Flush Access Doors with Concealed Flanges:

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Babcock-Davis; BIW.
  - b. JL Industries, Inc.; a division of the Activar Construction Products Group; FDWB.
  - c. Williams Bros. Corporation of America (The); WB-FR.
2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal; with concealed flange for gypsum board installation, self-closing door, and concealed hinge.
3. Locations: Wall and ceiling.
4. Door Size: As specified in Drawings.
5. Fire-Resistance Rating: Not less than that of adjacent construction.
6. Temperature-Rise Rating: 250 deg F (139 deg C) at the end of 30 minutes.
7. Uncoated Steel Sheet for Door: Nominal 0.036 inch (0.91 mm), 20 gage, factory primed.
8. Frame Material: Same material, thickness, and finish as door.
9. Latch and Lock: Self-closing, self-latching door hardware, operated by key.

## 2.4 MATERIALS

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

- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- D. Frame Anchors: Same material as door face.
- E. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

## 2.5 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
  - 1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
- D. Latch and Lock Hardware:
  - 1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
  - 2. Keys: Furnish two keys per lock and key all locks alike.

## 2.6 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.



1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.

### 3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 083113

## SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONT

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 Summary

- A. Section Includes: Kawneer Architectural Aluminum Storefront Systems, including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing of storefront units.
  - 1. Types of Kawneer Aluminum Storefront Systems include:
    - a. Trifab™ 400 Framing System – 1-3/4" x 4" (44.5 mm x 101.6 mm) nominal dimension; Non-Thermal; Center Plane, Screw Spline, Shear Block, Stick or Punched Opening Fabrication.
- B. Related Sections:
  - 1. 079210 Acoustical Joint Sealants
  - 2. 088000 "Glazing"
  - 3. 09 22 16 Non-Structural Metal Framing
  - 4. 09 22 16 Non-Structural Metal Framing

## 1.3 Definitions

- A. Definitions: For fenestration industry standard terminology and definitions refer to American Architectural Manufacturers Association (AAMA) – AAMA Glossary (AAMA AG).

## 1.4 Performance Requirements

- A. Storefront System Performance Requirements:
  - 1. Uniform Load: A static air design load of 20 psf (958 Pa) shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/175 of the span of any framing member. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.
- B. Environmental Product Declaration (EPD): Shall have a Type III Product-Specific EPD created from a Product Category Rule.

## 1.5 Submittals

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, hardware, finishes, and installation instructions for each type of aluminum-framed storefront system indicated.
  - 1. Recycled Content:

- a. Provide documentation that aluminum has a minimum of 50% mixed pre- and post-consumer recycled content with a sample document illustrating project specific information that will be provided after product shipment.
- b. Once product has shipped, provide project specific recycled content information, including:
  - 1) Indicate recycled content; indicate percentage of pre- and post-consumer recycled content per unit of product.
  - 2) Indicate relative dollar value of recycled content product to total dollar value of product included in project.
  - 3) Indicate location recovery of recycled content.
  - 4) Indicate location of manufacturing facility.
2. Environmental Product Declaration (EPD).
  - a. include a Type III Product-Specific EPD created from a Product Category Rule.
- B. Shop Drawings: Include plans, elevations, sections, details, hardware, and attachments to other work, operational clearances and installation details.
- C. Samples for Initial Selection: For units with factory-applied color finishes including samples of hardware and accessories involving color selection.
- D. Samples for Verification: For aluminum-framed storefront system and components required.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for each type, of aluminum-framed storefront.
- F. Fabrication Sample: Of each vertical-to-horizontal intersection of aluminum-framed systems, made from 12" (304.8 mm) lengths of full-size components and showing details of the following:
  1. Joinery, including concealed welds.
  2. Anchorage.
  3. Expansion provisions.
  4. Glazing.
  5. Flashing and drainage.
- G. Other Action Submittals:
  1. Entrance Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

#### 1.6 Quality Assurance

- A. Installer Qualifications: An installer which has had successful experience with installation of the same or similar units required for the project and other projects of similar size and scope.
- B. Manufacturer Qualifications: A manufacturer capable of providing aluminum-framed storefront system that meet or exceed performance requirements indicated and of documenting this performance by inclusion of test reports, and calculations.
- C. Source Limitations: Obtain aluminum-framed storefront system through one source from a single manufacturer.

- D. Product Options: Drawings indicate size, profiles, and dimensional requirements of aluminum-framed storefront system and are based on the specific system indicated. Refer to Division 01 Section “Product Requirements”. Do not modify size and dimensional requirements.
  - 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Build mockup for type(s) of storefront elevation(s) indicated, in location(s) shown on Drawings.
- F. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section “Project Management and Coordination”.

### 1.7 Project Conditions

- A. Field Measurements: Verify actual dimensions of aluminum-framed storefront openings by field measurements before fabrication and indicate field measurements on Shop Drawings.

### 1.8 Warranty

- A. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty.
  - 1. Warranty Period: Two (2) years from Date of Substantial Completion of the project provided however that the Limited Warranty shall begin in no event later than six months from date of shipment by manufacturer.
- B.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Basis-of-Design Product:
  - 1. Kawneer Company Inc.
  - 2. Trifab™ 400 Framing System (Non-Thermal)
  - 3. System Dimensions: 1-3/4" x 4" (44.5 mm x 101.6 mm)
  - 4. Glass: Center Plane
- B. Subject to compliance with requirements, provide a comparable product by the following:
  - 1. Profile dimension: 1-3/4" x 4"
- C. Substitutions: Refer to Substitutions Section for procedures and submission requirements
  - 1. Pre-Contract (Bidding Period) Substitutions: Submit written requests ten (10) days prior to bid date.
  - 2. Post-Contract (Construction Period) Substitutions: Submit written request in order to avoid storefront installation and construction delays.
  - 3. Product Literature and Drawings: Submit product literature and drawings modified to suit specific project requirements and job conditions.

4. Certificates: Submit certificate(s) certifying substitute manufacturer (1) attesting to adherence to specification requirements for storefront system performance criteria, and (2) has been engaged in the design, manufacturer and fabrication of aluminum storefront for a period of not less than ten (10) years. (Company Name)
  5. Test Reports: Submit test reports verifying compliance with each test requirement required by the project.
  6. Samples: Provide samples of typical product sections and finish samples in manufacturer's standard sizes.
- D. Substitution Acceptance: Acceptance will be in written form, either as an addendum or modification, and documented by a formal change order signed by the Owner and Contractor.

## 2.2 Materials

- A. Aluminum Extrusions: Alloy and temper recommended by aluminum storefront manufacturer for strength, corrosion resistance, and application of required finish and not less than 0.070" (1.8 mm) wall thickness at any location for the main frame and complying with ASTM B 221: 6063-T6 alloy and temper.
1. Recycled Content: Shall have a minimum of 50% mixed pre- and post-consumer recycled content.
    - a. Indicate recycled content; indicate percentage of pre-consumer and post-consumer recycled content per unit of product.
    - b. Indicate relative dollar value of recycled content product to total dollar value of product included in project.
    - c. Indicate location recovery of recycled content.
    - d. Indicate location of manufacturing facility.
- B. Fasteners: Aluminum, nonmagnetic stainless steel or other materials to be non-corrosive and compatible with aluminum framing members, trim hardware, anchors, and other components.
- C. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
- D. Reinforcing Members: Aluminum, nonmagnetic stainless steel, or nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions or other suitable zinc coating; provide sufficient strength to withstand design pressure indicated.
- E. Sealant: For sealants required within fabricated storefront system, provide permanently elastic, non-shrinking, and non-migrating type recommended by sealant manufacturer for joint size and movement.

- F. Tolerances: Reference to tolerances for wall thickness and other cross-sectional dimensions of storefront members are nominal and in compliance with AA Aluminum Standards and Data.

### 2.3 Storefront Framing System

- A. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials. Where exposes shall be stainless steel.
- C. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action
- D. Packing, Shipping, Handling and Unloading: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
- E. Storage and Protection: Store materials protected from exposure to harmful weather conditions. Handle storefront material and components to avoid damage. Protect storefront material against damage from elements, construction activities, and other hazards before, during and after storefront installation.

### 2.4 Glazing Systems

- A. Glazing: As specified in Division 08 Section "Glazing".
- B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, extruded EPDM rubber.
- C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.
- D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.
- E. Glazing Sealants: For structural-sealant-glazed systems, as recommended by manufacturer for joint type, and as follows:
  - 1. Weatherseal Sealant: ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O; single-component neutral-curing formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weatherseal-sealant, and aluminum-framed-system manufacturers for this use.

### 2.5 Entrance Door Systems

- A. Entrance Doors: As specified in Division 084113 Section "Aluminum-Framed Entrances and Storefronts".
- B. Entrance Door Hardware: As specified in Division 084113 Section "Door Hardware".

### 2.6 Accessory Materials

- A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 07 Section "Joint Sealants".

- B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for 30 mil (0.762 mm) thickness per coat.

## 2.7 Fabrication

- A. Extrude aluminum shapes before finishing.
- B. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
1. Profiles that are sharp, straight, and free of defects or deformations.
  2. Accurately fit joints; make joints flush, hairline and weatherproof.
  3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
  4. Physical and thermal isolation of glazing from framing members.
  5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
  6. Provisions for field replacement of glazing.
  7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- C. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- D. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.
- E. Storefront Framing: Fabricate components for assembly using manufacturer's standard installation instructions.
- F. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

## 2.8 Aluminum Finishes

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Factory Finishing:
1. Kawnear Permanodic™ AA-M10C21A44 / AA-M45C22A44, AAMA 611, Architectural Class I Color Anodic Coating (Color \_\_\_\_\_).
  2. Kawnear Permanodic™ AA-M10C21A41 / AA-M45C22A41, AAMA 611, Architectural Class I Clear Anodic Coating (Color #14 Clear) (Optional).
  3. Kawnear Permanodic™ AA-M10C21A31, AAMA 611, Architectural Class II Clear Anodic Coating (Color #17 Clear) (Standard).
  4. Kawnear Permafluor™ (70% PVDF), AAMA 2605, Fluoropolymer Coating (Color \_\_\_\_\_).
  5. Kawnear Permadize™ (50% PVDF), AAMA 2604, Fluoropolymer Coating (Color \_\_\_\_\_).
  6. Kawnear Permacoat™ AAMA 2604, Powder Coating (Color \_\_\_\_\_)
  7. Other: Manufacturer \_\_\_\_\_ Type \_\_\_\_\_ Color \_\_\_\_\_.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weather tight aluminum- framed storefront installation.
  - 1. Masonry Surfaces: Visibly dry and free of excess mortar, sand, and other construction debris.
  - 2. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches (76 mm) of opening.
  - 3. Metal Surfaces: Dry; clean; free of grease, oil, dirt, rust, corrosion, and welding slag; without sharp edges or offsets at joints.
  - 4. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 Installation

- A. Comply with Drawings, Shop Drawings, and manufacturer's written instructions for installing aluminum-framed storefront system, accessories, and other components.
- B. Install aluminum-framed storefront system level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
- C. Set sill members in bed of sealant or with gaskets, as indicated, for weather tight construction.
- D. Install aluminum-framed storefront system and components to drain condensation, water penetrating joints, and moisture migrating within aluminum-framed storefront system to the exterior.
- E. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

### 3.3 Field Quality Control

- A. Manufacturer's Field Services: Upon Owner's written request, provide periodic site visit by manufacturer's field service representative.

### 3.4 Adjusting, Cleaning, and Protection

- A. Clean aluminum surfaces immediately after installing aluminum-framed storefronts. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- B. Clean glass immediately after installation. Comply with glass manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels, and clean surfaces.
- C. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.



END OF SECTION 084113

## SECTION 08 52 13

## ALUMINUM-CLAD WOOD RECTANGULAR FIXED-FRAME WINDOWS

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Aluminum-clad wood fixed-frame windows.

## 1.2 RELATED SECTIONS

- A. Section 07 27 6 Fluid-Applied Membrane Air Barriers
- B. Section 07 92 00 - Joint Sealants: Sealants and caulking.

## 1.3 REFERENCES

- A. American Architectural Manufacturers Association (AAMA):
  - 1. AAMA 502 - Voluntary Specification for Field Testing of Windows and Sliding Doors.
  - 2. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels.
  - 3. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
  - 4. AAMA 611 Voluntary Specification for Anodized Architectural Aluminum.
  - 5. AAMA 612 Voluntary Specification, Performance Requirements, and Test Procedures for Combined Coatings of Anodic Oxide and Transparent Organic Coatings on Architectural Aluminum.
- B. American Society for Testing and Materials (ASTM):
  - 1. ASTM B 117 - Operating Salt Spray (Fog) Apparatus.
  - 2. ASTM C 1036 - Flat Glass.
  - 3. ASTM C 1048 - Heat-Treated Flat Glass – Kind HS, Kind FT Coated and Uncoated Glass.
  - 4. ASTM D 1149 - Rubber Deterioration – Surface Ozone Cracking in a Chamber.
  - 5. ASTM D 2803 - Filiform Corrosion Resistance of Organic Coatings on Metal.
  - 6. ASTM D 4060 - Abrasion Resistance of Organic Coatings by the Taber Abraser.
  - 7. ASTM E 283 - Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Difference Across the Specimen.
  - 8. ASTM E 330 - Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
  - 9. ASTM E 547 - Water Penetration of Exterior Windows, Curtain Walls and Doors by Cyclic Static Air Pressure Differential.
  - 11. ASTM E 1105 – Standard Test Method for Field Determination of Water Penetration of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
  - 12. ASTM G 85 - Modified Salt Spray (Fog) Testing.
- C. Window and Door Manufacturers Association (WDMA):
  - 1. AAMA/WDMA/CSA 101/I.S.2/A440 – North American Fenestration Standard/Specification for windows, doors and skylights
  - 2. WDMA I.S.4 - Industry Specification for Preservative Treatment for Millwork.

## 1.4 PERFORMANCE REQUIREMENTS

- A. Windows shall be Hallmark certified to a rating of CW-PG 90 specifications in accordance with ANSI/AAMA/WDMA 101/I.S.2/A440-08 or ANSI/AAMA/WDMA 101/I.S.2/A440-11.
- B. Window Unit Air Leakage, ASTM E 283, 6.24 psf (50 mph): 0.05 cfm per square foot of frame or less.
- C. Window Unit Water Penetration: No water penetration through window unit when tested in accordance with ASTM E 547, under static pressure of 14.2 psf (75 mph) after 4 cycles of 5 minutes each, with water being applied at a rate of 5 gallons per hour per square foot.
- D. U-factor .29, SHGC 0.23, VLT 0.51, SC .27, Outdoor Visible Light Reflectance .12

## 1.5 SUBMITTALS

- A. Comply with Division 1 requirements.
- B. Product Data: Submit manufacturer's product data, including installation instructions.
- C. Shop Drawings: Submit manufacturer's shop drawings, indicating dimensions, construction, component connections and locations, anchorage methods and locations, hardware locations, and installation details.
- D. Samples: Submit full-size or partial full-size sample of window illustrating glazing system, quality of construction, and color of finish.
- E. Warranty: Submit manufacturer's standard warranty.

## 1.6 QUALITY ASSURANCE

- A. Mockup:
  - 1. Provide sample installation to determine performance and acceptability of window installation methods.
  - 2. Approved mockup shall represent minimum quality required for the Work.
  - 3. Approved mockup shall [no remain in place within the Work.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site undamaged in manufacturer's or sales branch's original, unopened containers and packaging, with labels clearly identifying manufacturer and product name. Include installation instructions.
- B. Storage: Store materials in an upright position, off ground, under cover, and protected from weather, direct sunlight, and construction activities.
- C. Handling: Protect materials and finish during handling and installation to prevent damage.

# PART 2 PRODUCTS

## 2.1 MANUFACTURER

- A. Pella Corporation, 102 Main Street, Pella, Iowa 50219. Toll Free (800) 54-PELLA. Phone (641) 621-1000. Website [www.pella.com](http://www.pella.com).

## 2.2 ALUMINUM-CLAD WOOD FIXED-FRAME WINDOWS

- A. Aluminum-Clad Wood Fixed-Frame Windows: Pella “Clad Frame” factory-assembled, aluminum-clad wood, fixed-frame windows.
- B. Frame:
  - 1. Select woods, water-repellent, preservative-treated with EnduraGuard® in accordance with WDMA I.S.-4. EnduraGuard includes water-repellency, three active fungicides and an insecticide applied to the frame.
  - 2. Interior Exposed Surfaces: [Clear Pine] [Mahogany] [Douglas Fir] with no visible fastener holes.
  - 3. Exterior Surfaces: Clad with aluminum.
  - 4. Assembled with screws and concealed corner locks.
  - 5. Overall Frame Depth: 5 inches (127 mm).

## 2.3 GLAZING

- A. Glazing:
  - 1. Float Glass: ASTM C 1036, Quality 1.
    - a. Tempered Glass: ASTM C 1048.
  - 2. Type: Urethane-glazed, dual-seal, dual tempered clear Low-E SunDefense Low-E insulating glass with Argon fill, non-high altitude. Provide interior and exterior grilles as specified below.
  - 3. Type: Simulated-Divided-Light Glazing and Grilles:
    - a. Room Side Grilles: Solid 2-inch wide clear pine, water-repellent, preservative-treated in accordance with WDMA I.S.4.
    - b. Insulating glass contains non-glare spacer between the panes of glass.
    - c. Exterior Grilles: 2-inch wide extruded aluminum.
    - d. Adhere bars to both sides of insulating glass with VHB acrylic adhesive tape.
    - e. Finish: Finish color matches interior and exterior finish colors.

## 2.4 TOLERANCES

- A. Windows shall accommodate the following opening tolerances:
  - 1. Vertical Dimensions Between High and Low Points: Plus 1/4 inch, minus 0 inch.
  - 2. Width Dimensions: Plus 1/4 inch, minus 0 inch.
  - 3. Building Columns or Masonry Openings: Plus or minus 1/4 inch from plumb.

## 2.5 FINISH

- A. Exterior Finish System: Pella EnduraClad Plus.
  - 1. Exterior aluminum surfaces shall be finished with the following multi-stage system:
    - a. Clean and etch aluminum surface of oxides.
    - b. Pre-treat with chrome phosphate conversion coating.
    - c. Pre-treat with chromic acid sealer/rinse.
    - d. Top coat with baked-on 70% fluoropolymer-based enamel.
  - 2. Color: Black
  - 3. Performance Requirements: Exterior aluminum finishes shall meet or exceed all performance requirements of AAMA 2605.

- B. Interior Finish: Factory finished with 1 prime coat and 1 top coat of : Black

## 2.6 INSTALLATION ACCESSORIES

- A. Flashing/Sealant Tape: Pella SmartFlash.
  - 1. Aluminum-foil-backed butyl window and door flashing tape.
  - 2. Maximum Total Thickness: 0.013 inch.
  - 3. UV resistant.
  - 4. Verify sealant compatibility with sealant manufacturer.
- B. Interior Insulating-Foam Sealant: Low-expansion, low-pressure polyurethane insulating window and door foam sealant.
- C. Exterior Perimeter Sealant: “Pella Window and Door Installation Sealant” or equivalent high quality, multi-purpose sealant as specified in the joints sealant section.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine areas to receive windows. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

### 3.2 INSTALLATION

- A. Install windows in accordance with manufacturer's instructions and approved shop drawings.
- B. Install windows to be weather-tight and freely operating.
- C. Maintain alignment with adjacent work.
- D. Secure assembly to framed openings, plumb and square, without distortion.
- D. Integrate window system installation with exterior weather-resistant barrier using flashing/sealant tape. Apply and integrate flashing/sealant tape with weather-resistant barrier using watershed principles in accordance with window manufacturer's instructions.
- F. Place interior seal around window perimeter to maintain continuity of building thermal and air barrier using [backer rod and sealant] [insulating-foam sealant].
- G. Seal window to exterior wall cladding with sealant and related backing materials at perimeter of assembly.

### 3.3 CLEANING

- A. Clean window frames and glass in accordance with Division 1 requirements.
- B. Do not use harsh cleaning materials or methods that would damage finish.
- C. Remove labels and visible markings.

### 3.5 PROTECTION

- A. Protect installed windows to ensure that, except for normal weathering, windows will be without damage or deterioration at time of substantial completion.

END OF SECTION



## SECTION 087100 – DOOR HARDWARE

## 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 commercial door hardware for the following:
  - 1. Swinging doors.
  - 2. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
  - 1. Mechanical door hardware.
  - 2. Electromechanical door hardware.
  - 3. Cylinders specified for doors in other sections.
- C. Related Sections:
  - 1. Division 08 Section "Hollow Metal Doors and Frames".
  - 2. Division 08 Section "Flush Wood Doors".
  - 3. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
  - 4. Division 28 Section "Access Control Hardware Devices".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
  - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
  - 2. ICC/IBC - International Building Code.
  - 3. NFPA 70 - National Electrical Code.
  - 4. NFPA 80 - Fire Doors and Windows.
  - 5. NFPA 101 - Life Safety Code.
  - 6. NFPA 105 - Installation of Smoke Door Assemblies.
  - 7. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards:
  - 1. ANSI/BHMA Certified Product Standards - A156 Series



2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
  - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
  - 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
  - 3. Content: Include the following information:
    - a. Type, style, function, size, label, hand, and finish of each door hardware item.
    - b. Manufacturer of each item.
    - c. Fastenings and other pertinent information.
    - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    - e. Explanation of abbreviations, symbols, and codes contained in schedule.
    - f. Mounting locations for door hardware.
    - g. Door and frame sizes and materials.
    - h. Warranty information for each product.
  - 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the 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 Schedule.
- C. Shop Drawings: Details of electrified access control hardware indicating the following:
  - 1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

- a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
      - b. Complete (risers, point-to-point) access control system block wiring diagrams.
      - c. Wiring instructions for each electronic component scheduled herein.
    2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
  - D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
  - E. Informational Submittals:
    1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
  - F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.
- 1.4 QUALITY ASSURANCE
- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
  - B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
  - C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
  - D. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
  2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- F. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
1. Function of building, purpose of each area and degree of security required.
  2. Plans for existing and future key system expansion.
  3. Requirements for key control storage and software.
  4. Installation of permanent keys, cylinder cores and software.
  5. Address and requirements for delivery of keys.
- G. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
  2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
  3. Review sequence of operation narratives for each unique access controlled opening.
  4. Review and finalize construction schedule and verify availability of materials.
  5. Review the required inspecting, testing, commissioning, and demonstration procedures
- H. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

#### 1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.
- D. Building Information Modeling (BIM) Support: Utilize designated BIM software tools and obtain training needed to successfully participate in the Project BIM processes. All technical disciplines are responsible for the product data integration and data reliability of their Work into the coordinated BIM applications.

#### 1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
  - 1. Structural failures including excessive deflection, cracking, or breakage.
  - 2. Faulty operation of the hardware.
  - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
  1. Ten years for mortise locks and latches.
  2. Five years for exit hardware.
  3. Twenty five years for manual surface door closer bodies.
  4. Five years for motorized electric latch retraction exit devices.
  5. Two years for electromechanical door hardware.

## 1.8 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.

## PART 2 - PRODUCTS

### 2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
  1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

### 2.2 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:
    - a. Two Hinges: For doors with heights up to 60 inches.
    - b. Three Hinges: For doors with heights 61 to 90 inches.
    - c. Four Hinges: For doors with heights 91 to 120 inches.
    - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
  2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
    - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
    - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
  3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
    - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
    - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
  4. Hinge Options: Comply with the following:
    - a. Non-removable 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 the all out-swinging lockable doors.
  5. Manufacturers:
    - a. Hager Companies (HA) - CB Series.
    - b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - TA Series.
    - c. Stanley Hardware (ST) - CB Series.
- B. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.
1. Manufacturers:
    - a. Hager Companies (HA).
    - b. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
    - c. Stanley Hardware (ST).

## 2.3 POWER TRANSFER DEVICES

- A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
1. Manufacturers:
    - a. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE) – EL-CEPT Series.
    - b. Securitron (SU) - EL-CEPT Series.
    - c. Von Duprin (VD) - EPT-10 Series.
- B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.
1. Provide one each of the following tools as part of the base bid contract:
    - a. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Electrical Connecting Kit: QC-R001.
    - b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) - Connector Hand Tool: QC-R003.
  2. Manufacturers:
    - a. Hager Companies (HA) - Quick Connect.
    - b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK) – QC-C Series.
    - c. Stanley Hardware (ST) – WH Series.

## 2.4 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.
1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
  2. Furnish dust proof strikes for bottom bolts.
  3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.

4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
  5. Manufacturers:
    - a. Door Controls International (DC).
    - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    - c. Trimco (TC).
- B. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
  2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
  3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
  4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
  5. Manufacturers:
    - a. Hiawatha, Inc. (HI).
    - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    - c. Trimco (TC).

## 2.5 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
1. Manufacturers:
    - a. Sargent Manufacturing (SA).
- C. Cylinders: Original manufacturer cylinders complying with the following:
1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
  2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
  3. Bored-Lock Type: Cylinders with tailpieces to suit locks.



4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
  5. Keyway: Manufacturer's Standard.
- D. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
1. Removable Cores: Core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware. Provide removable core (small or large format) as specified in Hardware Sets.
- E. Patented Cylinders: ANSI/BHMA A156.5, Grade 1, certified cylinders employing a utility patented and restricted keyway requiring the use of patented controlled keys. Provide bump resistant, fixed core cylinders as standard with solid recessed cylinder collars. Cylinders are to be factory keyed where permanent keying records will be established and maintained.
1. Provide a 6 pin multi-level master key system comprised of patented controlled keys and security and high security cylinders operated by one (1) key of the highest level. Geographical exclusivity to be provided for all security and high security cylinders and UL437 certification where specified.
    - a. Level 1 Cylinders: Provide utility patented controlled keyway cylinders that are furnished with patented keys available only from authorized distribution.
    - b. Level 2 Cylinders: Provide utility patented controlled keyway and side bar locking incorporating unique angled bottom pins for geographical exclusivity. Cylinders constructed to provide protection against bumping and picking.
    - c. Level 3 Cylinders: Provide utility patented controlled keyway and side bar locking incorporating unique angled bottom pins for geographical exclusivity. Cylinders to be UL437 certified and constructed to provide protection against bumping, picking, and drilling.
    - d. Refer to hardware sets for specified levels.
  2. Manufacturers:
    - a. Sargent Manufacturing (SA) - Degree Series.
    - b. Corbin Russwin (RU) – Access 3 Series.
- F. Keying System: Each type of lock and cylinders to be factory keyed.
1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
  2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
  3. New System: Key locks to a new key system as directed by the Owner.
- G. Key Quantity: Provide the following minimum number of keys:
1. Change Keys per Cylinder: Three (3).
  2. Master Keys (per Master Key Level/Group): Five (5).

3. Construction Keys (where required): Ten (10).
4. Construction Control Keys (where required): Two (2).
5. Permanent Control Keys (where required): Two (2).

H. Construction Keying: Provide temporary keyed construction cores.

I. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

J. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Manufacturers:

- a. Lund Equipment (LU).
- b. MMF Industries (MM).
- c. Telkee (TK).

K. Key Control Software: Provide one network version of "Key Wizard" branded key management software package that includes one year of technical support and upgrades to software at no charge. Provide factory key system formatted for importing into "Key Wizard" software.

## 2.6 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

1. Manufacturers:

- a. Corbin Russwin Hardware (RU) – ML2000 Series.
- b. Sargent Manufacturing (SA) – 8200 Series.
- c. Yale Locks and Hardware (YA) – 8800FL Series.

## 2.7 ELECTROMECHANICAL LOCKING DEVICES

A. Electromechanical Mortise Locksets, Grade 1 (Heavy Duty): Subject to same compliance standards and requirements as mechanical mortise locksets, electrified locksets to be of type and design as specified below.

1. Electrified Lock Options: Where indicated in the Hardware Sets, provide electrified options including: outside door lock/unlock trim control, latchbolt and lock/unlock

status monitoring, deadbolt monitoring, and request-to-exit signaling. Support end-of-line resistors contained within the lock case. Unless otherwise indicated, provide electrified locksets standard as fail secure.

2. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
3. Manufacturers:
  - a. Corbin Russwin Hardware (RU) - ML20900 Series.
  - b. Sargent Manufacturing (SA) - 8200 Series.
  - c. Yale Locks and Hardware (YA) – 8800FL Series.

## 2.8 AUXILIARY LOCKS

- A. Narrow Case Deadlocks and Deadlatches: ANSI/BHMA 156.13 Series 1000 Grade 1 certified narrow case deadlocks and deadlatches for swinging or sliding door applications. All functions shall be manufactured in a single sized case formed from 12 gauge minimum, corrosion resistant steel (option for fully stainless steel case and components). Provide minimum 2 7/8" throw laminated stainless steel bolt. Bottom rail deadlocks to have 3/8" diameter bolts.

1. Manufacturers:
  - a. Adams Rite Manufacturing (AD) - MS1850S / MS1950 Series.

## 2.9 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

- B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

## 2.10 CONVENTIONAL EXIT DEVICES

### A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
5. Flush End Caps: Provide flush end caps made of architectural metal in the same finish as the devices as in the Hardware Sets. Plastic end caps will not be acceptable.
6. Energy Efficient Design: Provide lock bodies which have a holding current draw of 15mA maximum, and can operate on either 12 or 24 volts. Locks are to be field configurable for fail safe or fail secure operation.
7. Electromechanical Options: Subject to same compliance standards and requirements as mechanical exit devices, electrified devices to be of type and design as specified in hardware sets. Include any specific controllers when conventional power supplies are not sufficient to provide the proper inrush current.
8. Motorized Electric Latch Retraction: Devices with an electric latch retraction feature must use motors which have a maximum current draw of 600mA. Solenoid driven latch retraction is not acceptable.
9. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
  - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
  - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
10. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise

indicated. Provide dust proof strikes where thermal pins are required to project into the floor.

11. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
  12. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
  13. Rail Sizing: Provide exit device rails factory sized for proper door width application.
  14. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.
1. Manufacturers:
    - a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
    - b. Sargent Manufacturing (SA) - 80 Series.

## 2.11 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
  2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
  3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
  4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.
  5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
  6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.
  1. Manufacturers:
    - a. Corbin Russwin Hardware (RU) - DC6000 Series.
    - b. Sargent Manufacturing (SA) - 351 Series.
    - c. Norton Door Controls (NO) - 7500 Series.
    - d. Yale Locks and Hardware (YA) - 4400 Series.
- C. Door Closers, Surface Mounted (Commercial Duty): ANSI/BHMA 156.4, Grade 1 certified surface mounted, institutional grade door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck, closing sweep, and latch speed control valves. Provide non-handed units standard.
  1. Manufacturers:
    - a. Corbin Russwin Hardware (RU) - DC6000 Series.
    - b. Norton Door Controls (NO) - 8500 Series.
    - c. Sargent Manufacturing (SA) - 1431 Series.
    - d. Yale Locks and Hardware (YA) - 3500 Series.

## 2.12 ARCHITECTURAL TRIM

### A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult

manufacturer's catalog and template book for specific requirements for size and applications.

4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
  - a. Stainless Steel: 300 grade, .050-inch thick.
5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Manufacturers:
  - a. Hiawatha, Inc. (HI).
  - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
  - c. Trimco (TC).

## 2.13 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
  1. Manufacturers:
    - a. Hiawatha, Inc. (HI).
    - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    - c. Trimco (TC).
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
  1. Manufacturers:
    - a. Rixson Door Controls (RF).
    - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    - c. Sargent Manufacturing (SA).

## 2.14 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. 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 perimeter gasketing at all smoke labeled openings.
- C. 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 UL-10C.
  - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:
  - 1. National Guard Products (NG).
  - 2. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
  - 3. Reese Enterprises, Inc. (RE).

## 2.15 ELECTRONIC ACCESSORIES

- A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.
  - 1. Manufacturers:
    - a. Sargent Manufacturing (SA) – 3280 Series.
    - b. Securitron (SU) - DPS Series.



- B. Switching Power Supplies: Provide switching power supplies that are dual voltage, UL listed, supervised units. Units shall be field selectable with a dedicated battery charging circuit that provide 4 Amp at 12VDC or 24VDC continuous, with up to 16 independently controlled power limited outputs. Units shall tolerate brownout or overvoltage input  $\pm 15\%$  of nominal voltage and have thermal shutdown protection with auto restart. Circuit breaker shall protect against overcurrent and reverse battery faults and units shall be available with a single relay fire trigger or individually triggered relayed outputs. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw plus 50% for the specified electrified hardware and access control equipment.

- 1. Manufacturers:

- a. Securitron (SU) - AQ Series.

## 2.16 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

## 2.17 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine scheduled openings, 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. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

### 3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

### 3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
  - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically 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. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
  - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
  - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and 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.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

### 3.4 FIELD QUALITY CONTROL

- A. Field Inspection (Punch-Out Report): Reference Division 01 Section "Closeout Procedures". Final inspect installed door hardware and state in report whether work

complies with or deviates from specification requirements, including whether door hardware is properly installed, operating 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.

### 3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

### 3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

### 3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
- B. The supplier is responsible for handing and sizing all products and providing the correct option for the appropriate door type and material where more than one is presented in the hardware sets. Quantities listed are for each pair of doors, or for each single door.
- C. Manufacturer's Abbreviations:
  - 1. MK - McKinney
  - 2. PE - Pemko

3. AD - Adams Rite
4. RO - Rockwood
5. SA - SARGENT
6. RF - Rixson
7. SU - Securitron

### **Hardware Sets**

#### **Set: 1.0**

Doors: 100B, 101, 200B

Description: EXTERIOR - PAIR - ALUM (CARD ACCESS)

2 Continuous Hinge	CFM__SLF-HD1 PT - DOOR HEIGHT		PE
1 Concealed Vert Rod Exit, Dummy	DG164 16 55 AD8410	US32D	SA ⚡
1 Exit Device (nightlatch)	DG164 16 55 56 AD8410 106	US32D	SA ⚡
3 Core	DG1 6300	US15	SA
2 Pull	RM201 Mtg-Type 1XHD	US32D	RO
2 Conc Overhead Stop	6-X36	630	RF
2 Surface Closer	351 OZ	EN	SA
1 Threshold	252x3AFG MSES25SS		PE
1 Rain Guard	346C		PE
2 Sweep (w/ drip edge)	3452CNB		PE
2 Frame Harness	QC-C1500P		MK ⚡
2 Door Harness	QC-CXXX- LENGTH TO SUIT		MK ⚡
2 Electric Power Transfer	EL-CEPT		SU ⚡
1 Card Reader	BY SECURITY SUPPLIER		
2 Door Position Switch	DPS-M/W-BK		SU ⚡
1 Power Supply	AQDxx (TO SUIT)		SU ⚡
1 Wiring Diagram	Elevation and Point to Point as Specified		

#### Notes:

- Perimeter/meeting stile seals by frame/door supplier.
- Verify finish of hardware.
- Electronic Operation: Valid card or key retracts latchbolt. Request to exit shows authorized egress. Free egress at all times. In case of power loss, door remains locked and latched.

**Set: 2.0**

Doors: 202B

Description: EXTERIOR - SGL - ALUM (CARD ACCESS)

1 Continuous Hinge	CFM__SLF-HD1 PT - DOOR HEIGHT		PE
1 Exit Device (storeroom)	DG164 16 55 56 AD8504	US32D	SA ⚡
2 Core	DG1 6300	US15	SA
1 Pull	RM201 Mtg-Type 1XHD	US32D	RO
1 Conc Overhead Stop	6-X36	630	RF
1 Surface Closer	351 OZ	EN	SA
1 Threshold	252x3AFG MSES25SS		PE
1 Rain Guard	346C		PE
1 Sweep (w/ drip edge)	3452CNB		PE
1 Frame Harness	QC-C1500P		MK ⚡
1 Door Harness	QC-CXXX- LENGTH TO SUIT		MK ⚡
1 Electric Power Transfer	EL-CEPT		SU ⚡
1 Card Reader	BY SECURITY SUPPLIER		
1 Door Position Switch	DPS-M/W-BK		SU ⚡
1 Power Supply	AQDxx (TO SUIT)		SU ⚡
1 Wiring Diagram	Elevation and Point to Point as Specified		

## Notes:

- Perimeter/meeting stile seals by frame/door supplier.
- Verify finish of hardware.
- Electronic Operation: Valid card or key retracts latchbolt. Request to exit shows authorized egress. Free egress at all times. In case of power loss, door remains locked and latched.

**Set: 3.0**

Doors: 110

Description: EXTERIOR - SGL - RISER ROOM (CARD ACCESS)

1 Continuous Hinge	CFM__HD1 PT - DOOR HEIGHT		PE
1 Fail Secure Lock	DG164 RX 8271 LNMD	US26D	SA ⚡
1 Core	DG1 6300	US15	SA
1 Surface Closer	351 CPS	EN	SA

1 Kick Plate	K1050 10" CSK	US32D	RO
1 Threshold	252x3AFG MSES25SS		PE
1 Rain Guard	346C		PE
1 Gasketing (Head/Jambs)	S88BL		PE
1 Sweep (w/ drip edge)	3452CNB		PE
1 Frame Harness	QC-C1500P	MK	⚡
1 Door Harness	QC-CXXX- LENGTH TO SUIT	MK	⚡
1 Electric Power Transfer	EL-CEPT	SU	⚡
1 Card Reader	BY SECURITY SUPPLIER		
1 Door Position Switch	DPS-M/W-BK	SU	⚡
1 Power Supply	AQDxx (TO SUIT)	SU	⚡
1 Wiring Diagram	Elevation and Point to Point as Specified		

## Notes:

- Electronic Operation: Valid card unlocks outside lever. Request to exit shows authorized egress. Free egress at all times. In case of power loss, door remains locked and latched.

**Set: 4.0**

Doors: 100D, 102, 200A, 202A, 102A(Single)

Description: PAIR - ALUM - FITNESS, FAST TWITCH ZONES, TENANT

2 Continuous Hinge	CFM__SLF-HD1 - DOOR HEIGHT		PE
1 Threshold Bolt	4015-18-IB	603	AD
1 Header Bolt	4016		AD
1 Dust Proof Strike	570	US26D	RO
1 Mortise Deadlock	MS1850S	628	AD
1 Thumbturn Cylinder	4066	130	AD
1 Cylinder	DG1 64 As Required	US32D	SA
1 Core	DG1 6300	US15	SA
2 Push Bar & Pull	RM251	US32D	RO
2 Conc Overhead Stop	6-X36	630	RF
2 Surface Closer	1431 UO	EN	SA
1 Status Indicator	4089-00	130	AD

**Set: 5.0**

Doors: 109

Description: SGL - LAUNDRY

3 Hinge (heavy weight)	T4A3786	US26D	MK
1 Classroom Lock	DG164 8237 LNMD	US26D	SA
1 Core	DG1 6300	US15	SA
1 Surface Closer	351 UO	EN	SA
1 Kick Plate	K1050 10" CSK	US32D	RO
1 Mop Plate	K1050 4" CSK	US32D	RO
1 Door Stop	403/441CU (TO SUIT)	US26D	RO
3 Silencer	608/609 (TO SUIT)		RO

**Set: 6.0**

Doors: 204

Description: SGL - OFFICE

3 Hinge, Full Mortise	TA2714	US26D	MK
1 Office/Entry Lock	DG164 8205 LNMD	US26D	SA
1 Core	DG1 6300	US15	SA
1 Door Stop	403/441CU (TO SUIT)	US26D	RO
3 Silencer	608/609 (TO SUIT)		RO

**Set: 7.0**

Doors: 203A, 203B

Description: SGL - FITNESS STORAGE

3 Hinge, Full Mortise	TA2714	US26D	MK
1 Storeroom/Closet Lock	DG164 8204 LNMD	US26D	SA
1 Core	DG1 6300	US15	SA
1 Door Stop	403/441CU (TO SUIT)	US26D	RO
3 Silencer	608/609 (TO SUIT)		RO

**Set: 8.0**

Doors: 107, 108, 206, 209, 210

Description: SGL - JAN. CLOSET, WATER HEATER, ELEVATOR MACHINE RM.

3 Hinge, Full Mortise	TA2714	US26D	MK
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1 Storeroom/Closet Lock	DG164 8204 LNMD	US26D	SA
1 Core	DG1 6300	US15	SA
1 Surface Closer	351 UO	EN	SA
1 Kick Plate	K1050 10" CSK	US32D	RO
1 Door Stop	403/441CU (TO SUIT)	US26D	RO
1 Gasketing (Head/Jambs)	S88BL		PE

**Set: 9.0**

Doors: 205

Description: SGL - STAFF BREAK ROOM

3 Hinge, Full Mortise	TA2714	US26D	MK
1 Door Pull	RM3300-12 Mtg-Type 1	US32D	RO
1 Push Plate	70C	US32D	RO
1 Surface Closer	351 UO	EN	SA
1 Kick Plate	K1050 10" CSK	US32D	RO
1 Mop Plate	K1050 4" CSK	US32D	RO
1 Door Stop	403/441CU (TO SUIT)	US26D	RO
1 Gasketing (Head/Jambs)	S88BL		PE

**Set: 10.0**

Doors: 207, 208

Description: SGL - RESTROOM

3 Hinge, Full Mortise	TA2714	US26D	MK
1 Privacy Lock w/ Indicator	LB V20 8265 LNMD	US26D	SA
1 Surface Closer	351 UO	EN	SA
1 Kick Plate	K1050 10" CSK	US32D	RO
1 Mop Plate	K1050 4" CSK	US32D	RO
1 Door Stop	403/441CU (TO SUIT)	US26D	RO
1 Gasketing (Head/Jambs)	S88BL		PE
1 Coat Hook	RM801	US32D	RO

**Set: 11.0**

Doors: 100A, 100C

Description: GARAGE DR.

All Hardware by Garage Door  
Manufacturer.



END OF SECTION 087100

## SECTION 088000 - GLAZING

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section includes:
  - 1. Glass for interior doors, interior borrowed lites, and storefront framing.
  - 2. Glazing sealants and accessories.
- B. Related Requirements:
  - 1. Section 084113 "Aluminum-Framed Entrances and Storefronts."
  - 2. Section 088300 "Mirrors."

## 1.3 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. IBC: International Building Code

## 1.4 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

## 1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

2. Review temporary protection requirements for glazing during and after installation.

## 1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of the following products; 12 inches (300 mm) square.
  1. Tinted glass.
  2. Coated glass.
  3. Laminated glass.
  4. Tempered glass
- C. Glazing Accessory Samples: For sealants and colored spacers, in 12-inch (300-mm) lengths.
- D. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- E. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## 1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, glass testing agency, and sealant testing agency.
- B. Product Certificates: For glass.
- C. Product Test Reports: For tinted glass, coated glass, and glazing sealants, for tests performed by a qualified testing agency.
  1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- D. Preconstruction adhesion and compatibility test report.
- E. Sample Warranties: For special warranties.

## 1.8 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- B. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.

- C. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
- D. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
  - 1. Install glazing in mockups specified in Section 084113 "Aluminum-Framed Entrances and Storefronts" to match glazing systems required for Project, including glazing methods.
  - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

#### 1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
  - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F (4.4 deg C).

#### 1.11 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
  - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination

materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Guardian Industries Corp.; SunGuard.
  2. Oldcastle BuildingEnvelope.
  3. PPG Industries, Inc.
  4. Viracon, Inc.
- B. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

### 2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.
  1. Design Pressures: As indicated on Drawings.
  2. Thickness of Patterned Glass: Base design of patterned glass on thickness at thinnest part of the glass.
  3. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design pressure to not more than 1/50 times the short-side length or 1 inch (25 mm), whichever is less.
  4. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites of thickness indicated.
2. For laminated-glass lites, properties are based on products of construction indicated.
3. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

## 2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
  2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
1. **Minimum Glass Thickness for Exterior Lites: 6 mm.**
  2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
- D. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass. Where fully tempered float glass is indicated, provide fully tempered float glass.

## 2.4 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.
- B. Tinted Annealed Float Glass: ASTM C 1036, Type I, Class 2 (tinted), Quality-Q3.
- C. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
1. Fully Tempered Flat Glass to be by horizontal (roller hearth) process with inherent rollerwave distortion parallel to the bottom edge of the glass as installed.
  2. Maximum peak to valley rollerwave 0.003" (0.08mm) in the central area and 0.008" (0.20mm) within 10.5" (267mm) of the leading and trailing edge.

3. For clear or low-iron glass 1/4" to 3/8" thick without ceramic frit or ink, maximum + or – 100 mD (millidiopter) over 95% of the glass surface.
  4. Maximum bow and warp 1/32" per lineal foot (0.79mm).
  5. All tempered architectural safety glass shall conform with ANSI Z97.1 and CPSC 16 CFR 1201.
  6. For all fully tempered glass, provide heat soak testing conforming to EN14179 which includes a 2 hour dwell at 290°C±10°C.
- D. Heat-Strengthened Float Glass: ASTM C 1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
1. Heat-Strengthened Flat Glass to be by horizontal (roller hearth) process with inherent rollerwave distortion parallel to the bottom edge of the glass as installed.
  2. Maximum peak to valley rollerwave 0.003" (0.08mm) in the central area and 0.008" (0.20mm) within 10.5" (267mm) of the leading and trailing edge.
  3. For clear or low-iron glass 1/4" to 3/8" thick without ceramic frit or ink, maximum + or – 100 mD (millidiopter) over 95% of the glass surface.
  4. Maximum bow and warp 1/32" per lineal foot (0.79mm).
  5. All tempered architectural safety glass shall conform with ANSI Z97.1 and CPSC 16 CFR 1201.
- E. Reflective-Coated Vision Glass: ASTM C 1376.
- F. Ceramic-Coated Spandrel Glass: ASTM C 1048, Type I, Condition B, Quality-Q3.
- G. Reflective-Coated Spandrel Glass: ASTM C 1376, Kind CS.

## 2.5 LAMINATED GLASS

- A. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
1. Construction: Laminate glass with polyvinyl butyral interlayer to comply with interlayer manufacturer's written instructions.
  2. Interlayer Thickness: Provide thickness not less than that indicated and as needed to comply with requirements.
  3. Interlayer Color: Clear unless otherwise indicated.

## 2.6 GLAZING SEALANTS

- A. General:
1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
  3. Colors of Exposed Glazing Sealants: Match Architect's samples; unless otherwise noted.
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Dow Corning Corporation; Dow Corning® 790 Silicone Building Sealant.
    - b. GE Construction Sealants; Momentive Performance Materials Inc.; SCS2700 SilPruf LM.
    - c. Pecora Corporation; 890NST.
- C. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Dow Corning Corporation; Dow Corning® 795 Silicone Building Sealant.
    - b. GE Construction Sealants; Momentive Performance Materials Inc.; SCS2000 SilPruf.
    - c. Pecora Corporation; 864NST Silicone Sealant.
- D. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Dow Corning Corporation; DOW CORNING® 1199 SILICONE GLAZING SEALANT.
    - b. GE Construction Sealants; Momentive Performance Materials Inc.; SSG4000 UltraGlaze.
    - c. Polymeric Systems; PSI-631.
- E. Glazing Sealant: Acid-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use NT.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Dow Corning Corporation; DOW CORNING® 999A SILICONE GLAZING SEALANT.
    - b. GE Construction Sealants; Momentive Performance Materials Inc.; SCS1200 Construction.
    - c. Pecora Corporation; 860.



## 2.7 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; 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 glazing applications in which tape is subject to continuous pressure.
  - 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
  - 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
  - 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

## 2.8 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

## 2.9 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written

instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
  - a. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
  1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
  2. Presence and functioning of weep systems.
  3. Minimum required face and edge clearances.
  4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

#### 3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches (1270 mm).
  - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
  - 2. Provide 1/8-inch (3-mm) minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

### 3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

### 3.5 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

### 3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

### 3.7 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
  - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

### 3.8 GLASS SCHEDULE

- A. Glass Type: As indicated on Drawings.

END OF SECTION 088000

## SECTION 092116.23 - GYPSUM BOARD SHAFT WALL ASSEMBLIES

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section Includes: Gypsum board shaft wall assemblies.

## 1.3 ACTION SUBMITTALS

- A. Product Data: For each component of gypsum board shaft wall assembly.

## 1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For shaft wall assemblies and firestop tracks, from ICC-ES.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

## 1.6 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or with gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install interior products until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, or mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or blotchy surface contamination and discoloration.

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: Provide materials and construction identical to those of assemblies tested according to ASTM E 90 and classified according to ASTM E 413 by a testing and inspecting agency.
- C. Wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

## 2.2 GYPSUM BOARD SHAFT WALL ASSEMBLIES

- A. Fire-Resistance Rating: As indicated.
- B. STC Rating: As indicated.
- C. Studs: Manufacturer's standard profile for repetitive members, corner and end members, and fire-resistance-rated assembly indicated.
  - 1. Depth: As indicated by testing agency.
  - 2. Minimum Base-Metal Thickness: 0.033 inch (0.84 mm).
- D. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2 inches (51 mm) long and matching studs in depth.
  - 1. Minimum Base-Metal Thickness: Matching steel studs.
- E. Firestop Tracks: Provide firestop track at head of shaft wall on each floor level.
- F. Elevator Hoistway Entrances: Manufacturer's standard J-profile jamb strut with long-leg length of 3 inches (76 mm), matching studs in depth, and not less than 0.033 inch (0.84 mm) thick.
- G. Room-Side Finish: As indicated.
- H. Shaft-Side Finish: **As indicated by fire-resistance-rated assembly design designation.**
- I. Insulation: Sound attenuation blankets.

## 2.3 PANEL PRODUCTS

- A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
- B. Gypsum Shaftliner Board, Type X: ASTM C 1396/C 1396M; manufacturer's proprietary fire-resistive liner panels with paper faces.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. American Gypsum; Shaft Liner.
    - b. CertainTeed Corporation; GlasRoc Shaftliner
    - c. Georgia-Pacific Building Products; ToughRock Shaftliner.
    - d. National Gypsum Company; Gold Bond Brand Fire-Shield Shaftliner.
    - e. United States Gypsum Company; Sheetrock Brand Gypsum Liner Panel.
  - 2. Thickness: 1 inch (25.4 mm).
  - 3. Long Edges: Double bevel.
- C. Gypsum Shaftliner Board, Moisture- and Mold-Resistant Type X: ASTM C 1396/C 1396M; manufacturer's proprietary fire-resistive liner panels with moisture- and mold-resistant core and surfaces.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. American Gypsum; M-Bloc Shaft Liner.
    - b. CertainTeed Corporation; M2Tech Shaftliner Type X.
    - c. Georgia-Pacific Building Products; Dens-Glass Shaftliner.
    - d. National Gypsum Company; Gold Bond Brand Fire-Shield Shaftliner XP.
    - e. United States Gypsum Company; Sheetrock Brand Mold Tough Gypsum Liner Panel.
  - 2. Thickness: 1 inch (25.4 mm).
  - 3. Long Edges: Double bevel.
  - 4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- D. Gypsum Board: As specified in Section 092900 "Gypsum Board."
- E. Tile Backer Units: As specified in Section 092900 "Gypsum Board."

## 2.4 NON-LOAD-BEARING STEEL FRAMING

- A. Steel Framing Members: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
  - 1. Protective Coating: ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized unless otherwise indicated.



- B. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. CEMCO; California Expanded Metal Products Co.; FAS Track 1000.
    - b. ClarkDietrich Building Systems; BlazeFrame Fire Stop Deflection Track.
    - c. Fire Trak Corp; Fire Trak System.
    - d. Grace Construction Products; W.R. Grace & Co. -- Conn.; FlameSafe FlowTrak System.
    - e. Steel Network, Inc. (The); VertiTrack VTD.

## 2.5 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with manufacturer's written recommendations.
- B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes as specified in Section 092900 "Gypsum Board" that comply with gypsum board shaft wall assembly manufacturer's written recommendations for application indicated.
- C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
- D. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.
  - 1. Expansion Anchors: Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing according to ASTM E 488 conducted by a qualified testing agency.
  - 2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing according to ASTM E 1190 conducted by a qualified testing agency.
- E. Sound Attenuation Blankets: As specified in Section 092900 "Gypsum Board."
- F. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates to which gypsum board shaft wall assemblies attach or abut, with Installer present, including hollow-metal frames, elevator hoistway door frames, cast-in

anchors, and structural framing. Examine for compliance with requirements for installation tolerances and other conditions affecting performance.

- B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Sprayed Fire-Resistive Materials: Coordinate with gypsum board shaft wall assemblies so both elements of Work remain complete and undamaged. Patch or replace sprayed fire-resistive materials removed or damaged during installation of shaft wall assemblies to comply with requirements specified in Section 078100 "Applied Fireproofing."
- B. After sprayed fire-resistive materials are applied, remove only to extent necessary for installation of gypsum board shaft wall assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

### 3.3 INSTALLATION

- A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and ASTM C 754 other than stud-spacing requirements.
- B. Do not bridge building expansion joints with shaft wall assemblies; frame both sides of expansion joints with furring and other support.
- C. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, wall-mounted door stops, and similar items that cannot be supported directly by shaft wall assembly framing.
  - 1. Elevator Hoistway: At elevator hoistway-entrance door frames, provide jamb struts on each side of door frame.
  - 2. Reinforcing: Where handrails directly attach to gypsum board shaft wall assemblies, provide galvanized steel reinforcing strip with 0.033-inch (0.84-mm) minimum thickness of base metal (uncoated), accurately positioned and secured behind at least one layer of face panel.
- D. Penetrations: At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.
- E. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels, while maintaining continuity of fire-rated construction.

- F. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
- G. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect while maintaining fire-resistance rating of gypsum board shaft wall assemblies.
- H. Sound-Rated Shaft Wall Assemblies: Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly.
- I. Cant Panels: At projections into shaft [exceeding 4 inches (102 mm)] where indicated, install 5/8-inch- (13- or 16-mm-) thick gypsum board cants covering tops of projections.
  - 1. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 inches (610 mm) o.c. with screws fastened to shaft wall framing.
  - 2. Where steel framing is required to support gypsum board cants, install framing at 24 inches (610 mm) o.c. and extend studs from the projection to shaft wall framing.
- J. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

### 3.4 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, or mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092116.23

## SECTION 092216 - NON-STRUCTURAL METAL FRAMING

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

## A. Section Includes:

- 1. Non-load-bearing steel framing systems for interior partitions.
- 2. Suspension systems for interior ceilings and soffits.
- 3. Grid suspension systems for gypsum board ceilings.

## B. Related Requirements:

- 1. Section 054000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.

## 1.3 ACTION SUBMITTALS

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

- 1. Studs and Runners: Provide documentation that framing members' certification is according to SIFA's "Code Compliance Certification Program for Cold-Formed Steel Structural and Non-Structural Framing Members."

## B. Shop Drawings:

- 1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
- 2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
- 3. Drawings shall indicate sequence and method of erection details of all connections of cold-formed steel framing to other elements of the building structure.

- C. Delegated-Design Submittal: For non-structural metal framing. Include analysis data and shop drawings signed and sealed by a qualified professional engineer, licensed in the project state, responsible for their preparation.

## 1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For embossed steel studs and runners and firestop tracks, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- C. Horizontal Deflection: For wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 5 lbf/sq. ft. (239 Pa).

### 2.2 FRAMING SYSTEMS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than **25** percent.
- B. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
  - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
  - 2. Protective Coating: ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized unless otherwise indicated.
- C. Studs and Runners: ASTM C 645.
  - 1. Steel Studs and Runners:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) CEMCO; California Expanded Metal Products Co.
      - 2) MBA Building Supplies.
      - 3) MRI Steel Framing, LLC.
      - 4) Phillips Manufacturing Co.
    - b. Minimum Base-Metal Thickness: 0.0329 inch (0.836 mm).
    - c. Depth: As indicated on Drawings.

## 2. Embossed Steel Studs and Runners:

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1) CEMCO; California Expanded Metal Products Co.
  - 2) ClarkDietrich Building Systems.
  - 3) Marino\WARE.
  - 4) MBA Building Supplies.
  - 5) Phillips Manufacturing Co.
- b. Minimum Base-Metal Thickness: 0.0190 inch (0.483 mm).
- c. Depth: As indicated on Drawings.

## D. Slip-Type Head Joints: Where indicated, provide the following:

- 1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to runners while allowing 1-1/2-inch (38-mm) minimum vertical movement.
  - a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) CEMCO; California Expanded Metal Products Co.; Deflex Clips.
    - 2) ClarkDietrich Building Systems; FTC3 or FTC5.
    - 3) Fire Trak Corp; RediKlip.
- 2. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- (51-mm-) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
- 3. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- (51-mm-) deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
- 4. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
  - a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) BlazeFrame Industries; Bare Slotted Track (BST/BST 2).
    - 2) CEMCO; California Expanded Metal Products Co.; CST Slotted Deflection Track or SLP-TRK Slotted Deflection Track.
    - 3) ClarkDietrich Building Systems; SLP-TRK Slotted Deflection Track.
    - 4) MBA Building Supplies; Slotted Deflecto Track.

## E. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated

assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Blazeframe Industries; Intumescent Framing, Fire Stop System.
  - b. CEMCO; California Expanded Metal Products Co.; FAS Track.
  - c. ClarkDietrich Building Systems; BlazeFrame.
  - d. Fire Trak Corp; Fire Trak System attached to studs with Fire Trak Posi Klip.
- F. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ClarkDietrich Building Systems.
    - b. MRI Steel Framing, LLC.
  2. Minimum Base-Metal Thickness: 0.0329 inch (0.836 mm).
- G. Cold-Rolled Channel Bridging: Steel, 0.0538-inch (1.367-mm) minimum base-metal thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ClarkDietrich Building Systems.
    - b. MRI Steel Framing, LLC.
  2. Depth: 1-1/2 inches (38 mm).
  3. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), 0.068-inch- (1.72-mm-) thick, galvanized steel.
- H. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. ClarkDietrich Building Systems.
    - b. Marino\WARE.
    - c. MRI Steel Framing, LLC.
  2. Minimum Base-Metal Thickness: 0.0329 inch (0.836 mm).
  3. Depth: As indicated on Drawings.
- I. Resilient Furring Channels: 1/2-inch- (13-mm-) deep, steel sheet members designed to reduce sound transmission.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ClarkDietrich Building Systems.
    - b. Marino\WARE.
    - c. MRI Steel Framing, LLC.
  2. Configuration: **Asymmetrical or hat shaped.**
- J. Cold-Rolled Furring Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
1. Depth: As indicated on Drawings.
  2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch (0.8 mm).
  3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.
- K. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 7/8 inch (22 mm), minimum uncoated-metal thickness of 0.0179 inch (0.455 mm), and depth required to fit insulation thickness indicated.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ClarkDietrich Building Systems.
    - b. Marino\WARE.
    - c. MRI Steel Framing, LLC.

## 2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.
- B. Hanger Attachments to Concrete:
1. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488/E 488M conducted by a qualified testing agency.
  2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch (4.12 mm) in diameter.



- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch (1.367 mm) and minimum 1/2-inch- (13-mm-) wide flanges.
  - 1. Depth: As indicated on Drawings.
- E. Furring Channels (Furring Members):
  - 1. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22 mm) deep.
    - a. Minimum Base-Metal Thickness: 0.0329 inch (0.836 mm).
  - 2. Resilient Furring Channels: 1/2-inch- (13-mm-) deep members designed to reduce sound transmission.
    - a. Configuration: **Asymmetrical or hat shaped.**
- F. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Armstrong World Industries, Inc; Drywall Grid Systems.
    - b. Chicago Metallic Corporation; **640/660 Drywall Ceiling Suspension**
    - c. United States Gypsum Company; **Drywall Suspension System**

## 2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
  - 1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
  - 1. Asphalt-Saturated Organic Felt: ASTM D 226/D 226M, Type I (No. 15 asphalt felt), nonperforated.
  - 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
  - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
- B. Coordination with Sprayed Fire-Resistive Materials:
  - 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches (610 mm) o.c.
  - 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that are required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

### 3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
  - 1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
  - 2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
  - 3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
  - 4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

### 3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
  - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
  - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
    - a. Install two studs at each jamb unless otherwise indicated.
    - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
    - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
  - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
  - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
    - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
  - 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
  - 6. Curved Partitions:
    - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
    - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches (150 mm) o.c.
- E. Direct Furring:

1. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

F. Z-Shaped Furring Members:

1. Erect insulation, specified in Section 072100 "Thermal Insulation," vertically and hold in place with Z-shaped furring members spaced 24 inches (610 mm) o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches (305 mm) from corner and cut insulation to fit.

- G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

### 3.5 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Hangers: 48 inches (1219 mm) o.c.
2. Carrying Channels (Main Runners): 48 inches (1219 mm) o.c.
3. Furring Channels (Furring Members): 24 inches (610 mm) o.c.

- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

- C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
  - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
  - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  5. Do not attach hangers to steel roof deck.
  6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
  7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
  8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

## SECTION 092900 - GYPSUM BOARD

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

## A. Section Includes:

- 1. Interior gypsum board.
- 2. Exterior gypsum board for ceilings and soffits.
- 3. Tile backing panels.

## B. Related Requirements:

- 1. Section 061600 "Sheathing" for gypsum sheathing for exterior walls.
- 2. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.
- 3. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

## 1.3 ACTION SUBMITTALS

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

## B. Samples: For the following products:

- 1. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.
- 2. Textured Finishes: **Manufacturer's standard size** for each textured finish indicated and on same backing indicated for Work.

## 1.4 QUALITY ASSURANCE

## A. Mockups: Build mockups of at least 100 sq. ft. (9 sq. m) in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.

## 1. Build mockups for the following:

- a. Each level of gypsum board finish indicated for use in exposed locations.

2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.

## 1.5 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

## 1.6 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.
  1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- C. Ceiling and wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

### 2.2 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

## 2.3 INTERIOR GYPSUM BOARD

### A. Gypsum Board, Type X: ASTM C 1396/C 1396M.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. American Gypsum; FireBloc Type X Gypsum Wallboard.
  - b. CertainTeed Corporation; Type X.
  - c. Georgia-Pacific Building Products; ToughRock Fireguard X.
  - d. National Gypsum Company; Gold Bond Brand Fire-Shield Wallboard.
  - e. United States Gypsum Company; USG Sheetrock Brand Firecode® X Gypsum Panels.
2. Thickness: 5/8 inch (15.9 mm).
3. Long Edges: Tapered.

### B. Flexible Gypsum Board: ASTM C 1396/C 1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. CertainTeed Corporation; 1/4" Flex.
  - b. National Gypsum Company; High Flex Wallboard.
  - c. United States Gypsum Company; USG Sheetrock Brand Flexible Gypsum Panels.
2. Thickness: 1/4 inch (6.4 mm).
3. Long Edges: Tapered.

### C. Gypsum Ceiling Board: ASTM C 1396/C 1396M.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. American Gypsum; 1/2" Interior Ceiling Board.
  - b. CertainTeed Corporation; Interior Ceiling Gypsum Board.
  - c. Georgia-Pacific Building Products; ToughRock Span 24 Ceiling Board.
  - d. National Gypsum Company; Gold Bond Brand High Strength Ceiling Board.
  - e. United States Gypsum Company; USG Imperial Sag-Resistant Interior Ceiling Gypsum Base.
2. Thickness: 1/2 inch (12.7 mm).
3. Long Edges: Tapered.

### D. Abuse-Resistant Gypsum Board: ASTM C 1629/C 1629M.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. American Gypsum; M-Bloc AR Type X Wallboard.



- b. CertainTeed Corporation; AirRenew Extreme Abuse.
    - c. National Gypsum Company; Hi-Abuse Brand XP Fire-Shield Wallboard.
    - d. United States Gypsum Company; USG Sheetrock Brand Mold Tough Abuse-Resistant VHI Firecode Core.
  2. Core: 5/8 inch (15.9 mm), Type X.
  3. Surface Abrasion: Meets or exceeds Level 2 requirements.
  4. Surface Indentation: Meets or exceeds Level 1 requirements.
  5. Single-Drop Soft-Body Impact: Meets or exceeds Level 2 requirements.
  6. Long Edges: Tapered.
  7. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- E. Impact-Resistant Gypsum Board: ASTM C 1629/C 1629M.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. American Gypsum; M-Bloc IR Type X Wallboard.
    - b. CertainTeed Corporation; AirRenew Extreme Impact.
    - c. Georgia-Pacific Building Products; DensArmor Plus Impact-Resistant Interior Panel.
    - d. National Gypsum Company; Gold Bond Brand Hi-Impact XP.
    - e. United States Gypsum Company; USG Sheetrock Brand Mold Tough Abuse-Resistant VHI Firecode Core.
  2. Core: 5/8 inch (15.9 mm), Type X.
  3. Surface Abrasion: Meets or exceeds Level 2 requirements.
  4. Surface Indentation: Meets or exceeds Level 1 requirements.
  5. Single-Drop Soft-Body Impact: Meets or exceeds Level 3 requirements.
  6. Hard-Body Impact: Meets or exceeds Level 2 requirements according to test in Annex A1.
  7. Long Edges: Tapered.
  8. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- F. Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. American Gypsum; M-Bloc Type X.
    - b. CertainTeed Corporation; M2Tech Moisture and Mold.
    - c. Georgia-Pacific Building Products; DensArmor Plus Fireguard.
    - d. National Gypsum Company; Gold Bond Brand Fire-Shield Board.
    - e. United States Gypsum Company; USG Sheetrock Brand Mold Tough®Gypsum Panels.
  2. Core: 5/8 inch (15.9 mm), Type X.

3. Long Edges: Tapered.
4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

## 2.4 SPECIALTY GYPSUM BOARD

- A. Gypsum Board, Type C: ASTM C 1396/C 1396M. Manufactured to have increased fire-resistive capability.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. American Gypsum; FireBloc Type C Gypsum Wallboard.
    - b. CertainTeed Corporation; Type C.
    - c. Georgia-Pacific Building Products; Fireguard C.
    - d. National Gypsum Company; Gold Bond Fire-Shield C.
    - e. United States Gypsum Company; USG Imperial Gypsum Base, Firecode C.
  2. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
  3. Long Edges: Tapered.
- B. Acoustically Enhanced Gypsum Board: ASTM C 1396/C 1396M. Multilayer products constructed of two layers of gypsum boards sandwiching a viscoelastic sound-absorbing polymer core.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. CertainTeed Corporation; QuietRock 530.
    - b. National Gypsum Company; SoundBreak XP.
  2. Core: As indicated.
  3. Long Edges: Tapered.

## 2.5 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

- A. Exterior Gypsum Soffit Board:  
See specification section 072500 - GYPSUM BOARD WEATHER-RESISTANT BARRIER AND AIR BARRIER SYSTEM
- B. Glass-Mat Gypsum Sheathing Board:  
See specification section 072500 - GYPSUM BOARD WEATHER-RESISTANT BARRIER AND AIR BARRIER SYSTEM

## 2.6 TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Board:  
See specification section 072500 - GYPSUM BOARD WEATHER-RESISTANT BARRIER AND AIR BARRIER SYSTEM

## 2.7 TRIM ACCESSORIES

### A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:
  - a. Cornerbead.
  - b. Bullnose bead.
  - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
  - d. L-Bead: L-shaped; exposed long flange receives joint compound.
  - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
  - f. Expansion (control) joint.
  - g. Curved-Edge Cornerbead: With notched or flexible flanges.

### B. Exterior Trim: ASTM C 1047.

1. Material: Hot-dip galvanized-steel sheet, plastic, or rolled zinc.
2. Shapes:
  - a. Cornerbead.
  - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
  - c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

## 2.8 JOINT TREATMENT MATERIALS

### A. General: Comply with ASTM C 475/C 475M.

### B. Joint Tape:

1. Interior Gypsum Board: Paper.
2. Exterior Gypsum Soffit Board: per section 072500
3. Glass-Mat Gypsum Sheathing Board: per section 072500
4. Tile Backing Panels: As recommended by panel manufacturer.

### C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
  - a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.

5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.
- D. Joint Compound for Exterior Applications:
1. Exterior Gypsum Soffit Board: per section 072500
  2. Glass-Mat Gypsum Sheathing Board: per section 072500.
- E. Joint Compound for Tile Backing Panels:
1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
  2. Cementitious Backer Units: As recommended by backer unit manufacturer.
  3. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

## 2.9 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
1. Adhesives shall have a VOC content of **50** g/L or less.
  2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
- D. Sound-Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- E. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."
- F. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."
- G. Vapor Retarder: As specified in Section 072600 "Vapor Retarders."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
  - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
  - 2. Fit gypsum panels around ducts, pipes, and conduits.
  - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

### 3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
  - 1. Wallboard Type: As indicated on Drawings.
  - 2. Type X: As indicated on Drawings.
  - 3. Flexible Type: **Apply in double layer at curved assemblies.**
  - 4. Ceiling Type: Ceiling surfaces.
  - 5. Abuse-Resistant Type: As indicated on Drawings.
  - 6. Impact-Resistant Type: As indicated on Drawings.
  - 7. Mold-Resistant Type: As indicated on Drawings.
  - 8. Type C: As indicated on Drawings.
  - 9. Glass-Mat Interior Type: As indicated on Drawings.
  - 10. Acoustically Enhanced Type: As indicated on Drawings.
- B. Single-Layer Application:
  - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
  - 2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
  - 3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
  - 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Multilayer Application:
  - 1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing

- member, 16 inches (400 mm) minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
  3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
  4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

D. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- (300-mm-) long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches (400 mm) o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches (300 mm) o.c.

### 3.4 APPLYING EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS

- A. Apply panels perpendicular to supports, with end joints staggered and located over supports.
1. Install with 1/4-inch (6.4-mm) open space where panels abut other construction or structural penetrations.
  2. Fasten with corrosion-resistant screws.

### 3.5 APPLYING TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at locations indicated to receive tile. Install with 1/4-inch (6.4-mm) gap where panels abut other construction or penetrations.

### 3.6 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners unless otherwise indicated.
2. Bullnose Bead: Use where indicated.
3. LC-Bead: Use at exposed panel edges.
4. L-Bead: Use where indicated.
5. U-Bead: Use where indicated.
6. Curved-Edge Cornerbead: Use at curved openings.

D. Exterior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. LC-Bead: Use at exposed panel edges.

### 3.7 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
  1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
  2. Level 2: Panels that are substrate for tile.
  3. Level 3: Where indicated on Drawings.
  4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
    - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
  5. Level 5: Where indicated on Drawings.
    - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
- E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
- F. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.



### 3.8 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

## SECTION 093013 - CERAMIC TILING

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

## A. Section Includes:

1. Ceramic mosaic tile.
2. Quarry tile.
3. Porcelain tile.
4. Glazed wall tile.
5. Stone thresholds.
6. Waterproof membrane.
7. Crack isolation membrane.
8. Metal edge strips.

## B. Related Requirements:

1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.
2. Section 092900 "Gypsum Board" for glass-mat, water-resistant backer board.
3. Section 093033 "Stone Tiling."

## 1.3 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."
- C. Module Size: Actual tile size plus joint width indicated.
- D. Face Size: Actual tile size, excluding spacer lugs.

#### 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
  - 1. Product Data: For adhesives, indicating VOC content.
  - 2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
  - 3. Laboratory Test Reports: For sealers, indicating compliance with requirements for low-emitting materials.
- C. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- D. Samples for Initial Selection: For tile, grout, and accessories involving color selection.
- E. Samples for Verification:
  - 1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.
  - 2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 36 inches (900 mm) square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.
  - 3. Full-size units of each type of trim and accessory for each color and finish required.
  - 4. Stone thresholds in 6-inch (150-mm) lengths.
  - 5. Metal edge strips in 6-inch (150-mm) lengths.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- C. Product Certificates: For each type of product.
- D. Product Test Reports: For tile-setting and -grouting products.

## 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
  - 2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

## 1.8 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Installer is a five-star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.
  - 2. Installer's supervisor for Project holds the International Masonry Institute's Foreman Certification.
  - 3. Installer employs Ceramic Tile Education Foundation Certified Installers or installers recognized by the U.S. Department of Labor as Journeyman Tile Layers.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Build mockup of each type of floor tile installation.
  - 2. Build mockup of each type of wall tile installation.
  - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

## 1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.
  - 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
  - 1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
  - 2. Obtain waterproof membrane and crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
  - 1. Stone thresholds.
  - 2. Waterproof membrane.
  - 3. Crack isolation membrane.
  - 4. Metal edge strips.

### 2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
  - 1. Provide tile complying with Standard grade requirements.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

## 2.3 TILE PRODUCTS

- A. Ceramic Tile: As indicated on Drawings.

## 2.4 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
  - 1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch (1.5 mm) above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch (12.7 mm) or less above adjacent floor surface.
- B. Granite Thresholds: ASTM C 615/C 615M.
  - 1. Description: Match Architect's sample.
- C. Marble Thresholds: ASTM C 503/C 503M, with a minimum abrasion resistance of 10 according to ASTM C 1353 or ASTM C 241/C 241M and with honed finish.
  - 1. Description: Match Architect's sample.

## 2.5 WATERPROOF MEMBRANE

- A. General: Manufacturer's standard product that complies with ANSI A118.10 and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

## 2.6 CRACK ISOLATION MEMBRANE

- A. General: Manufacturer's standard product that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

## 2.7 SETTING MATERIALS

- A. Portland Cement Mortar (Thickset) Installation Materials: ANSI A108.02.
  - 1. Cleavage Membrane: Asphalt felt, ASTM D 226/D 226M, Type I (No. 15); or polyethylene sheeting, ASTM D 4397, 4.0 mils (0.1 mm) thick.
  - 2. Reinforcing Wire Fabric: Galvanized, welded-wire fabric, 2 by 2 inches (50.8 by 50.8 mm) by 0.062-inch (1.57-mm) diameter; comply with ASTM A 185/A 185M and ASTM A 82/A 82M, except for minimum wire size.
  - 3. Expanded Metal Lath: Diamond-mesh lath complying with ASTM C 847.

- a. Base Metal and Finish for Interior Applications: Uncoated or zinc-coated (galvanized) steel sheet, with uncoated steel sheet painted after fabrication into lath.
  - b. Base Metal and Finish for Exterior Applications: Zinc-coated (galvanized) steel sheet.
  - c. Configuration over Studs and Furring: Flat.
  - d. Configuration over Solid Surfaces: Self-furring.
  - e. Weight: 2.5 lb/sq. yd. (1.4 kg/sq. m).
4. Latex Additive: Manufacturer's standard water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement and aggregate mortar bed.
- B. Dry-Set Portland Cement Mortar (Thinset): ANSI A118.1.
  1. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.1.
- C. Latex-Portland Cement Mortar (Thinset): ANSI A118.4.
  1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
  2. Provide prepackaged, dry-mortar mix combined with acrylic resin liquid-latex additive at Project site.
  3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.
- D. Medium-Bed, Latex-Portland Cement Mortar: Comply with requirements in ANSI A118.4. Provide product that is approved by manufacturer for application thickness of 5/8 inch (16 mm).
  1. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
  2. Provide prepackaged, dry-mortar mix combined with acrylic resin liquid-latex additive at Project site.
- E. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3.
  1. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
  2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F (60 and 100 deg C), respectively, and certified by manufacturer for intended use.

## 2.8 GROUT MATERIALS

- A. Sand-Portland Cement Grout: ANSI A108.10, consisting of white or gray cement and white or colored aggregate as required to produce color indicated.

- B. Standard Cement Grout: ANSI A118.6.
- C. High-Performance Tile Grout: ANSI A118.7.
  - 1. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.
  - 2. Polymer Type: Acrylic resin in liquid-latex form for addition to prepackaged dry-grout mix.
- D. Water-Cleanable Epoxy Grout: ANSI A118.3, with a VOC content of 65 g/L or less.
  - 1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F (60 and 100 deg C), respectively, and certified by manufacturer for intended use.
- E. Grout for PregROUTed Tile Sheets: Same product used in factory to pregROUT tile sheets.

## 2.9 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Vapor-Retarder Membrane: Polyethylene sheeting, ASTM D 4397, 4.0 mils (0.1 mm) thick.
- C. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A 666, 300 Series exposed-edge material.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Blanke Corporation.
    - b. Ceramic Tool Company, Inc.
    - c. Schluter Systems L.P.
- D. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- E. Floor Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Bonsal American, an Oldcastle company; Grout Sealer.
    - b. Custom Building Products; Grout Sealer.
    - c. Jamo Inc; Grout Sealer.
    - d. Southern Grouts & Mortars, Inc; Grout Sealer.



- e. TEC; H.B. Fuller Construction Products Inc.; Grout Guard Plus Penetrating Grout Sealer.
- 2. Products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

## 2.10 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
  - 2. Verify that concrete substrates for tile floors installed with bonded mortar bed or thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
    - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
  - 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
  - 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.
- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

### 3.3 CERAMIC TILE INSTALLATION

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
  - 1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
    - a. Tile floors in wet areas.
    - b. Tile floors consisting of tiles 8 by 8 inches (200 by 200 mm) or larger.
    - c. Tile floors consisting of rib-backed tiles.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
- F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
  2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
  3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
1. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).
  2. Quarry Tile: 1/4 inch (6.4 mm).
  3. Glazed Wall Tile: 1/16 inch (1.6 mm).
  4. Porcelain Tile: 1/8 inch (6.4 mm).
- H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- J. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.
1. At locations where mortar bed (thickset) would otherwise be exposed above adjacent floor finishes, set thresholds in latex-portland cement mortar (thinset).
  2. Do not extend cleavage membrane, waterproofing or crack isolation membrane under thresholds set in dry-set portland cement or latex-portland cement mortar. Fill joints between such thresholds and adjoining tile set on cleavage membrane, waterproofing or crack isolation membrane with elastomeric sealant.
- K. Metal Edge Strips: Install at locations indicated.
- L. Floor Sealer: Apply floor sealer to grout joints according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.
- 3.4 TILE BACKING PANEL INSTALLATION
- A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

### 3.5 WATERPROOFING INSTALLATION

- A. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
- B. Allow waterproofing to cure and verify by testing that it is watertight before installing tile or setting materials over it.

### 3.6 CRACK ISOLATION MEMBRANE INSTALLATION

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
- B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

### 3.7 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
  - 1. Remove grout residue from tile as soon as possible.
  - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

### 3.8 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.9 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

- A. Interior Floor Installations, Concrete Subfloor
  - a. See finish drawings.
- B. Interior Wall Installations, Masonry or Concrete:
  - a. See finish drawings.
- C. Interior Wall Installations, Wood or Metal Studs or Furring:
  - a. See finish drawings.

END OF SECTION 093013

## SECTION 093033 - STONE TILING

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section Includes:
  - 1. Dimension stone tile.
- B. Related Requirements:
  - 1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in stone tile surfaces.

## 1.3 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."
- C. Dimension Stone Tile: Modular stone units less than 3/4 inch (19 mm) thick.
- D. Module Size: Actual tile size plus joint width.
- E. Polished Finish: Smooth surface that produces sharp, mirrorlike reflections. Reflected images of overhead fluorescent tubes have straight lines without visible distortion when viewed at arm's length.
- F. Honed Finish: Smooth, nonreflective surface similar to that produced by grinding with a 400- to 1200-grit abrasive; with a gap not exceeding 0.005 inch (0.13 mm) when faces are tested for flatness with a 24-inch (610-mm) straightedge.
- G. Sand-Rubbed Finish: Uniform, fine-textured surface similar to that produced by grinding with a 40-grit abrasive; with a gap not exceeding 1/32 inch (0.8 mm) when faces are tested for flatness with a 24-inch (610-mm) straightedge.

#### 1.4 SEQUENCING AND SCHEDULING

- A. Sequence stone tile installation with other work to minimize possibility of damage and soiling during remainder of construction period.
- B. Install stone tile and accessories only after other finishing operations, including painting, are completed.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show locations of each type of stone tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in substrates and finished stone tile surfaces.
- C. Samples for Verification:
  - 1. Full-size units of each type of stone tile.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For dimension stone tile to include in maintenance manuals.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use.
- B. Store stone tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

#### 1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install stone tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations for Stone Tile: Obtain each stone product type from single source from single producer.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
  - 1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.

### 2.2 STONE PRODUCTS

- A. Varieties and Sources: Subject to compliance with requirements, provide those indicated.
- B. <Double click to insert sustainable design text for regional stone materials.>
- C. Provide stone products that are free of defects impairing their function for use indicated, including cracks, seams, and starts.
- D. Stone Tile Type[ **ST-<#>**]:
  - 1. Stone Type: Quartz-based stone, complying with ASTM C 616/C 616M, Classification.
  - 2. Finish: [**Polished**] [**Honed**] [**Sand rubbed**] [**Thermal**] [**Natural cleft**] [**As indicated**].
  - 3. Edges: Square.
  - 4. Module Size: [**6 by 6 inches (152 by 152 mm)**] [**6 by 12 inches (152 by 305 mm)**] [**12 by 12 inches (305 by 305 mm)**] [**300 by 300 mm**] [**18 by 18 inches (457 by 457 mm)**] [**500 by 500 mm**] [**As indicated**].
  - 5. Nominal Tile Thickness: [**1/4 inch (6 mm)**] [**3/8 inch (10 mm)**] [**1/2 inch (13 mm)**] [**5/8 inch (16 mm)**].
  - 6. Joint Width: [**Hand tight**] [**1/16 inch (1.5 mm)**] [**1/8 inch (3 mm)**] [**1/4 inch (6 mm)**] [**3/8 inch (10 mm)**] [**1/2 inch (13 mm)**].

### 2.3 SETTING MATERIALS

- A. Polymer-Modified Cement Mortar (Thinset): ANSI A118.4.
  - 1. Custom Building Products; VersaBond® Professional ThinSet Mortar

### 2.4 GROUT MATERIALS

- A. Standard Cement Grout: ANSI A118.6.



1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)

B. High-Performance Tile Grout: ANSI A118.7.

1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)
2. Polymer Type: Ethylene vinyl acetate or acrylic additive, in dry, redispersible form, prepackaged with other dry ingredients.
3. Polymer Type: [**Acrylic resin**] [**or**] [**styrene-butadiene rubber**] in liquid-latex form for addition to prepackaged dry-grout mix.

## 2.5 MISCELLANEOUS MATERIALS

- A. Protective Coating: Liquid grout-release coating that is formulated to protect exposed surfaces of stone tile against adherence of mortar and grout; compatible with stone, mortar, and grout products; easily removable after grouting is completed without damaging grout or stone tile; and recommended for use as temporary protective coating for stone tile.

1. Floor sealer complying with "Floor Sealer" Paragraph below may be used provided it is recommended by manufacturer for use as a grout release.

- B. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming stone tile and grout surfaces, specifically approved for materials and installations indicated by stone tile producers and grout manufacturers.

- C. Floor Sealer: Colorless, stain- and slip-resistant sealer, not affecting color or physical properties of stone surfaces as recommended by stone tile producers for application indicated.

1. [<Double click here to find, evaluate, and insert list of manufacturers and products.>](#)

## 2.6 FABRICATION

- A. Facial Dimensions of Stone Tiles with [**Polished**] [**or**] [**Honed**] Faces: Do not vary facial dimensions from specified dimensions by more than plus or minus **1/64 inch (0.4 mm)**.

- B. Facial Dimensions of Stone Tiles with [**Sand-Rubbed**] [**Natural-Cleft**] [**or**] [**Thermal-Finished**] Faces: Do not vary facial dimensions from specified dimensions by more than plus or minus **1/32 inch (0.8 mm)**.

- C. Thickness of Stone Tiles with [**Polished**] [**Honed**] [**or**] [**Sand-Rubbed**] Finish: Do not vary from specified thickness by more than plus or minus **1/32 inch (0.8 mm)**.

- D. Joint Surfaces: Except for specified beveled or eased edges if any, dress joint surfaces square for full depth of stone tile.

## 2.7 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where stone tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for stone tile floors installed with thinset mortar with trowelable patching compound specifically recommended by tile-setting material manufacturer.

### 3.3 STONE TILE INSTALLATION

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in stone tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods specified in stone tile installation schedules, and apply to types of setting and grouting materials used.
  - 1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
    - a. Stone tile floors consisting of stone tiles 8 by 8 inches (200 by 200 mm) or larger.
    - b. Stone tile floors consisting of stone tiles 8 by 8 inches (200 by 200 mm) or larger.
- B. Wipe backs of stone tiles with a damp cloth to remove dirt and dust before units are installed.
- C. Extend stone tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate

work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

- D. Accurately form intersections and returns. Perform cutting and drilling of stone tile without marring visible surfaces. Carefully grind cut edges of stone tile abutting trim, finish, or built-in items for straight aligned joints. Fit stone tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap stone tile.
- E. Finish cut stone tile edges that will not be concealed by other construction by grinding and honing cut surfaces to match factory-fabricated edges unless otherwise indicated.
- F. Jointing Pattern: Lay stone tile in grid pattern unless otherwise indicated. Lay out stone tile work and center stone tile fields in both directions in each space or on each wall area. Lay out stone tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
  - 1. Where adjoining stone tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
  - 2. Where stone tiles are specified or indicated to be whole integer multiples of adjoining stone tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- G. Match stone tiles within each space by selecting tiles to achieve uniformity of color and pattern. Reject or relocate stone tiles that do not match color and pattern of adjacent tiles.
- H. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and stone tile. Do not saw-cut joints after installing stone tiles.
  - 1. Where joints occur in concrete substrates, locate joints in stone tile surfaces directly above them.

### 3.4 INSTALLATION TOLERANCES

- A. Variation in Level: For horizontal joints and other conspicuous lines, do not exceed **1/8 inch in 10 ft. (3 mm in 3 m)**, or **1/2 inch (12 mm)**.
- B. Variation in Surface Plane of Flooring: Do not exceed **1/8 inch in 10 ft. (3 mm in 3 m)** from level or slope indicated when tested with a **10-ft. (3-m)** straightedge.
- C. Variation in Plane between Adjacent Units (Lipping): Do not exceed the following differences between faces of adjacent units as measured from a straightedge parallel to stone tiled surface:
  - 1. Units with Polished Faces: **1/64 inch (0.4 mm)**.
  - 2. Units with Honed Faces: [**1/64 inch (0.4 mm)**] [**1/32 inch (0.8 mm)**].
  - 3. Units with Sand-Rubbed Faces: **1/32 inch (0.8 mm)**.

- D. Variation in Joint Width: Do not vary joint thickness more than **1/16 inch (1.6 mm)** or one-fourth of nominal joint width, whichever is less.
- E. Hand-Tight Joints: Do not exceed [**1/64 inch (0.4 mm)**] [**1/32 inch (0.8 mm)**].

### 3.5 ADJUSTING AND CLEANING

- A. Cleaning: On completion of placement and grouting, clean stone tile surfaces so they are free of foreign matter.
  - 1. Remove grout residue from stone tile as soon as possible.
  - 2. Clean grout smears and haze from stone tile according to stone tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by stone tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of stone tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
- B. Apply sealer to cleaned stone tile flooring according to sealer manufacturer's written instructions.

### 3.6 PROTECTION

- A. Protect installed stone tile floors with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by stone tile manufacturer, apply coat of neutral protective cleaner to completed stone tile walls and floors.
- B. Prohibit foot and wheel traffic from stone tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from stone tile surfaces.

END OF SECTION 093033

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## SECTION 095113 - ACOUSTICAL PANEL CEILINGS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section includes acoustical panels and exposed suspension systems for ceilings.
- B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

## 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

## 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, 6 inches (150 mm) in size.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Suspended ceiling components.
  - 2. Structural members to which suspension systems will be attached.
  - 3. Size and location of initial access modules for acoustical panels.
  - 4. Items penetrating finished ceiling including the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
    - c. Speakers.
    - d. Sprinklers.
    - e. Access panels.

5. Perimeter moldings.

- B. Qualification Data: For testing agency.
- C. Product Test Reports: For each acoustical panel ceiling, for tests performed a qualified testing agency.
- D. Evaluation Reports: For each acoustical panel ceiling suspension system from ICC-ES.
- E. Field quality-control reports.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

#### 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.
  - 2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
  - 3. Hold-Down Clips: Equal to 2 percent of quantity installed.
  - 4. Impact Clips: Equal to 2 percent of quantity installed.

#### 1.8 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to NVLAP for testing indicated.
- B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Build mockup of typical ceiling area as shown on Drawings.
  - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

## 1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
  - 2. Smoke-Developed Index: 50 or less.
- C. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
- D. Ceiling products shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

### 2.2 ACOUSTICAL PANELS, GENERAL

- A. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.
- B. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.
- C. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
  - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches (400 mm) away from test surface according to ASTM E 795.



- D. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
  - 1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

## 2.3 ACOUSTICAL PANELS

- A. Products: As indicated on Drawings.

## 2.4 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.
  - 1. High-Humidity Finish: Comply with ASTM C 635/C 635M requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.
- B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
  - 1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
    - a. Type: Postinstalled expansion [Postinstalled bonded] anchors.
    - b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
    - c. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchor.
    - d. Corrosion Protection: Components fabricated from nickel-copper-alloy rods complying with ASTM B 164 for UNS No. N04400 alloy.
  - 2. Power-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 hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.

- C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
  - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
  - 2. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304, nonmagnetic.
  - 3. Nickel-Copper-Alloy Wire: ASTM B 164, nickel-copper-alloy UNS No. N04400.
  - 4. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.
- D. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- E. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
- F. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
- G. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in place.
- H. Hold-Down Clips: Where indicated, provide manufacturer's standard hold-down clips spaced 24 inches (610 mm) o.c. on all cross tees.
- I. Impact Clips: Where indicated, provide manufacturer's standard impact-clip system designed to absorb impact forces against acoustical panels.

## 2.5 METAL SUSPENSION SYSTEM

- A. Products: As indicated on Drawings.

## 2.6 METAL EDGE MOLDINGS AND TRIM

- A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
  - 1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
  - 2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
  - 3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.

4. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils (0.04 mm). Comply with ASTM C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

## 2.7 ACOUSTICAL SEALANT

- A. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."

## 2.8 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 2.9 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

## 2.10 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and Cisca's "Ceiling Systems Handbook."
  1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.
- B. Suspend ceiling hangers from building's structural members and as follows:
  1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
  2. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.

4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
  5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
  6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
  7. Do not attach hangers to steel deck tabs.
  8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  9. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches (200 mm) from ends of each member.
  10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
  2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3.2 mm in 3.6 m). Miter corners accurately and connect securely.
  3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
  2. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
  3. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
  4. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions unless otherwise indicated.
  5. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

2.11 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
  - 1. Compliance of seismic design.
- B. Acoustical panel ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

2.12 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

## SECTION 096513 - RESILIENT BASE AND ACCESSORIES

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section Includes:
  - 1. Resilient base.
  - 2. Resilient molding accessories.

## 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
  - 1. Product Data: For adhesives, indicating VOC content.
  - 2. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.
  - 3. Laboratory Test Reports: For resilient base, indicating compliance with requirements for low-emitting materials.
- C. Samples for Initial Selection: For each type of product indicated.
- D. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches (300 mm) long.
- E. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

## 1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

## 1.5 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Coordinate mockups in this Section with mockups specified in other Sections.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

## 1.7 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive resilient products during the following time periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.
- C. Install resilient products after other finishing operations, including painting, have been completed.

# PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Resilient base shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

## 2.2 THERMOPLASTIC-RUBBER BASE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Allstate Rubber Corp.
  - 2. Armstrong World Industries, Inc.
  - 3. Johnsonite; A Tarkett Company.
  - 4. Roppe Corporation, USA.
  - 5. Johnsonite; A Tarkett Company

- B. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).
  - 1. Group: I (solid, homogeneous).
  - 2. Style and Location:
    - a. Style A, Straight, Toeless: Provide in areas with carpet.
    - b. Style B, Cove: Provide in areas with resilient flooring and exposed concrete.
    - c. Style C, Butt to: Provide in areas indicated.
    - d. Style D, Sculptured: Provide in areas indicated.
  - 1) Profile: As indicated on drawings.
- C. Thickness & Height: as indicated on drawings.
- D. Lengths: Cut lengths 48 inches (1219 mm) long or coils in manufacturer's standard length.
- E. Outside Corners: Preformed.
- F. Inside Corners: Job formed or preformed.
- G. Colors: As selected by Architect from full range of industry colors.

## 2.3 VINYL BASE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Armstrong World Industries, Inc.
  - 2. Johnsonite; A Tarkett Company.
  - 3. Roppe Corporation, USA.
- B. Product Standard: ASTM F 1861, Type TV (vinyl, thermoplastic).
  - 1. Group: I (solid, homogeneous).
  - 2. Style and Location:
    - a. Style A, Straight, Toeless: Provide in areas with carpet.
    - b. Style B, Cove: Provide in areas with resilient flooring and exposed concrete.
- C. Minimum Thickness: 0.125 inch (3.2 mm).
- A. Height:
  - 1. As indicated on drawings.
- B. Lengths: Cut lengths 48 inches (1219 mm) long or coils in manufacturer's standard length.
- C. Outside Corners: Preformed.



- D. Inside Corners: Job formed or preformed.
- E. Colors and Patterns: As selected by Architect from full range of industry colors.

## 2.4 RUBBER MOLDING ACCESSORY

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - 1. Roppe Corporation, USA.
  - 2. Johnsonite.
- B. Description: Rubber **cap for cove carpet, cap for cove resilient flooring, carpet bar for tackless installations, carpet edge for glue-down applications, nosing for carpet, nosing for resilient flooring, reducer strip for resilient flooring, joiner for tile and carpet, transition strips etc.**
- C. Profile and Dimensions: As indicated in drawings.
- D. Locations: Provide rubber molding accessories in areas indicated.
- E. Colors and Patterns: As selected by Architect from full range of industry colors.

## 2.5 VINYL MOLDING ACCESSORY

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Armstrong World Industries, Inc.
  - 2. Johnsonite; A Tarkett Company.
  - 3. Roppe Corporation, USA.
- B. Description: Vinyl **cap for cove carpet, cap for cove resilient flooring, carpet bar for tackless installations, carpet edge for glue-down applications, nosing for carpet, nosing for resilient flooring, reducer strip for resilient flooring, joiner for tile and carpet, transition strips etc..**
- C. Profile and Dimensions: As indicated in drawings.
- D. Locations: Provide vinyl molding accessories in areas indicated.
- E. Colors and Patterns: As selected by Architect from full range of industry colors.

## 2.6 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
  - 1. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of flooring, and in maximum available lengths to minimize running joints.
- D. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient stair-tread manufacturer.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
  - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
  - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

#### 3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F 710.
  - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
  - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.

4. Moisture Testing: Proceed with installation only after substrates pass testing according to manufacturer's written recommendations, but not less stringent than the following:
  - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation 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) in 24 hours.
  - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient products until they are the same temperature as the space where they are to be installed.
  1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

### 3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.
- H. Job-Formed Corners:
  1. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches (76 mm) in length.
    - a. Miter or cope corners to minimize open joints.

### 3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

### 3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
  - 1. Remove adhesive and other blemishes from exposed surfaces.
  - 2. Sweep and vacuum horizontal surfaces thoroughly.
  - 3. Damp-mop horizontal surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from resilient stair treads before applying liquid floor polish.
  - 1. Apply three coat(s).
- E. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

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## SECTION 099120 - PAINTING AND COATINGS

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes surface preparation and field painting of exposed exterior and interior items and surfaces.

## 1.2 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Samples: For each type of finish-coat material indicated.

## 1.3 QUALITY ASSURANCE

- A. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample for each type of coating and substrate required. Comply with procedures specified in PDCA P5.
  - 1. Wall Surfaces: Provide samples on at least 100 sq. ft. (9 sq. m).
  - 2. Small Areas and Items: Architect will designate items or areas required.
  - 3. Final approval of colors will be from benchmark samples.

## 1.4 PROJECT CONDITIONS

- A. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain storage containers in a clean condition, free of foreign materials and residue.
- B. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F (10 and 32 deg C).
- C. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F (7 and 35 deg C).
- D. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

## 1.5 EXTRA MATERIALS

- A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.

1. Quantity: 3 percent, but not less than 1 gal. (3.8 L) or 1 case, as appropriate, of each material and color applied.

## 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.
- C. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
  1. Sherwin-Williams Co. (Sherwin-Williams).
  2. Benjamin Moore & Co. (Benjamin Moore).
  3. PPG Industries, Inc. (Pittsburgh Paints).

### 2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
- C. Colors: As selected from manufacturer's full range.

### 2.3 PREPARATORY COATS

- A. Concrete Unit Masonry Block Filler: High-performance latex block filler of finish coat manufacturer and recommended in writing by manufacturer for use with finish coat and on substrate indicated.
- B. Exterior Primer: Exterior alkyd or latex-based primer of finish coat manufacturer and recommended in writing by manufacturer for use with finish coat and on substrate indicated.
  1. Ferrous-Metal and Aluminum Substrates: Rust-inhibitive metal primer.
  2. Zinc-Coated Metal Substrates: Galvanized metal primer.

3. Where manufacturer does not recommend a separate primer formulation on substrate indicated, use paint specified for finish coat.
- C. Interior Primer: Interior latex-based or alkyd primer of finish coat manufacturer and recommended in writing by manufacturer for use with finish coat and on substrate indicated.
1. Ferrous-Metal Substrates: Quick drying, rust-inhibitive metal primer.
  2. Zinc-Coated Metal Substrates: Galvanized metal primer.
  3. Where manufacturer does not recommend a separate primer formulation on substrate indicated, use paint specified for finish coat.

## 2.4 EXTERIOR FINISH COATS

A. Exterior Flat Acrylic Paint:

1. Sherwin-Williams; A-100 Exterior Latex Flat House & Trim Paint A6 Series.
2. Benjamin Moore; Moorcraft Super Spec Flat Latex House Paint No. 171.
3. Pittsburgh Paints; 6-600 Series SpeedHide Exterior House Paint Flat Latex.

B. Exterior Low-Luster Acrylic Paint:

1. Sherwin-Williams; A-100 Exterior Latex Satin House & Trim Paint A82 Series.
2. Benjamin Moore; Moorcraft Super Spec Low Lustre Latex House Paint No. 185.
3. Pittsburgh Paints; 6-2000 Series SpeedHide Exterior House & Trim Satin--Acrylic Latex.
4. Pittsburgh Paints; 90-400 Series Pitt-Tech One Pack High Performance Waterborne Satin DTM Industrial Enamels.

C. Exterior Semigloss Acrylic Enamel:

1. Sherwin-Williams; A-100 Latex Gloss A8 Series.
2. Benjamin Moore; Moorcraft Super Spec Latex House & Trim Paint No. 170.
3. Pittsburgh Paints; 6-900 Series SpeedHide Exterior House & Trim Semi-Gloss Acrylic Latex Paint.

D. Exterior Full-Gloss Acrylic Enamel for Concrete, Masonry, and Wood:

1. Sherwin-Williams; SuperPaint Exterior High Gloss Latex Enamel A85 Series.
2. Sherwin-Williams; DTM Acrylic Coating Gloss (Waterborne) B66W100 Series.
3. Benjamin Moore; Moore's IMC Acrylic Gloss Enamel M28.
4. Pittsburgh Paints; 90 Line Pitt-Tech One Pack Interior/Exterior High Performance Waterborne High Gloss DTM Industrial Enamels.

E. Exterior Full-Gloss Acrylic Enamel for Ferrous and Other Metals:

1. Sherwin-Williams; DTM Acrylic Coating Gloss (Waterborne) B66W100 Series.
2. Benjamin Moore; Moore's IMC Acrylic Gloss Enamel M28.
3. Pittsburgh Paints; 90-300 Series Pitt-Tech One Pack Interior/Exterior High Performance Waterborne High Gloss DTM Industrial Enamels.



## F. Exterior Full-Gloss Alkyd Enamel:

1. Sherwin-Williams; Industrial Enamel B-54 Series.
2. Benjamin Moore; Moore's IMC Urethane Alkyd Enamel M22.
3. Pittsburgh Paints; 7-814 Pittsburgh Paints Industrial Gloss-Oil Interior/Exterior Enamel.

## 2.5 INTERIOR FINISH COATS

## A. Interior Flat Acrylic Paint:

1. Sherwin-Williams; ProMar 200 Interior Latex Flat Wall Paint B30W200 Series.
2. Benjamin Moore; Moorecraft Super Spec Latex Flat No. 275.
3. Pittsburgh Paints; 6-70 Line SpeedHide Interior Wall Flat-Latex Paint.

## B. Interior Flat Latex-Emulsion Size:

1. Sherwin-Williams; ProMar 200 Interior Latex Flat Wall Paint B30W200 Series.
2. Benjamin Moore; Moorecraft Super Spec Latex Flat No. 275.
3. Pittsburgh Paints; 6-70 Line SpeedHide Interior Wall Flat-Latex Paint.

## C. Interior Low-Luster Acrylic Enamel:

1. Sherwin-Williams; ProMar 200 Interior Latex Egg-Shell Enamel B20W200 Series.
2. Benjamin Moore; Moorcraft Super Spec Latex Eggshell Enamel No. 274.
3. Pittsburgh Paints; 6-400 Series SpeedHide Eggshell Acrylic Latex Enamel.

## D. Interior Semigloss Acrylic Enamel:

1. Sherwin-Williams; ProMar 200 Interior Latex Semi-Gloss Enamel B31W200 Series.
2. Benjamin Moore; Moorcraft Super Spec Latex Semi-Gloss Enamel No. 276.
3. Pittsburgh Paints; 6-500 Series SpeedHide Interior Semi-Gloss Latex.

## E. Interior Full-Gloss Acrylic Enamel:

1. Sherwin-Williams; ProMar 200 Interior Latex Gloss Enamel B21W201.
2. Benjamin Moore; Moore's IMC Acrylic Gloss Enamel No. M28.
3. Pittsburgh Paints; 6-8534 SpeedHide Interior Latex 100 Percent Acrylic Gloss Enamels.
4. Pittsburgh Paints; 90-374 Pitt-Tech One Pack Interior/Exterior High Performance Waterborne High Gloss DTM Industrial Enamel.

## F. Interior Semigloss Alkyd Enamel:

1. Sherwin-Williams; ProMar 200 Interior Alkyd Semi-Gloss Enamel B34W200 Series.
2. Benjamin Moore; Moorcraft Super Spec Alkyd Semi-Gloss Enamel No. 271.
3. Pittsburgh Paints; 6-1110 Series SpeedHide Interior Enamel Wall & Trim Semi-Gloss Oil.

## G. Interior Full-Gloss Alkyd Enamel for Gypsum Board and Plaster:

1. Sherwin-Williams; ProMar 200 Alkyd Gloss Enamel B35W200 Series.
2. Benjamin Moore; Moore's IMC Urethane Alkyd Enamel No. M22.
3. Pittsburgh Paints; 7-814 Series Pittsburgh Paints Industrial Gloss-Oil Interior/Exterior Enamel.

## H. Interior Full-Gloss Alkyd Enamel for Wood and Metal Surfaces:

1. Sherwin-Williams; ProMar 200 Alkyd Gloss Enamel B35W200 Series.
2. Benjamin Moore; Moore's IMC Urethane Alkyd Enamel No. M22.
3. Pittsburgh Paints; 7-814 Series Pittsburgh Paints Industrial Gloss-Oil Interior/Exterior Enamel.

## 2.6 INTERIOR WOOD STAINS AND VARNISHES

## A. Open-Grain Wood Filler:

1. Sherwin-Williams; Sher-Wood Fast-Dry Filler.
2. Sherwin-Williams; none recommended.
3. Benjamin Moore; Benwood Paste Wood Filler No. 238.
4. Pittsburgh Paints; none required.

## B. Interior Wood Stain: Alkyd based.

1. Sherwin-Williams; Wood Classics Interior Oil Stain A-48 Series.
2. Benjamin Moore; Benwood Penetrating Stain No. 234.
3. Pittsburgh Paints; 77-560 Rez Interior Semi-Transparent Oil Stain.

## C. Clear Sanding Sealer: Fast-drying alkyd based.

1. Sherwin-Williams; Wood Classics Fast Dry Sanding Sealer B26V43
2. Benjamin Moore; Moore's Interior Wood Finishes Quick-Dry Sanding Sealer No. 413.
3. Pittsburgh Paints; 6-10 SpeedHide Quick-Drying Interior Sanding Wood Sealer and Finish.

## D. Interior Alkyd- or Polyurethane-Based Clear Satin Varnish:

1. Sherwin-Williams; Wood Classics Fast Dry Oil Varnish, Satin A66-300 Series.
2. Benjamin Moore; Benwood Interior Wood Finishes Polyurethane Finishes Low Lustre No. 435.
3. Pittsburgh Paints; 77-7 Rez Varnish, Interior Satin Oil Clear.

## E. Interior Waterborne Clear Satin Varnish: Acrylic-based polyurethane.

1. Sherwin-Williams; Wood Classics Waterborne Polyurethane Satin, A68 Series.
2. Benjamin Moore; Stays Clear Acrylic Polyurethane No. 423, Satin.
3. Pittsburgh Paints; 77-49 Rez Satin Acrylic Clear Polyurethane.

- F. Interior Waterborne Clear Gloss Varnish: Acrylic-based polyurethane.
  - 1. Sherwin-Williams; Wood Classics Waterborne Polyurethane Gloss, A68 Series.
  - 2. Benjamin Moore; Benwood Interior Wood Finishes Polyurethane Finishes High Gloss No. 428.
  - 3. Pittsburgh Paints; 77-45 Rez Full-Gloss Acrylic Clear Polyurethane.
- G. Paste Wax: As recommended by manufacturer.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Comply with procedures specified in PDCA P4 for inspection and acceptance of surfaces to be painted.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
- C. Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- D. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
  - 1. Provide barrier coats over incompatible primers or remove and reprime.
  - 2. Cementitious Materials: Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
  - 3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
    - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
    - b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including cabinets, counters, cases, and paneling.
    - c. If transparent finish is required, backprime with spar varnish.

- d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.
    - e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.
  - 4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.
    - a. Blast steel surfaces clean as recommended by paint system manufacturer and according to SSPC-SP 6/NACE No. 3.
    - b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
    - c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.
  - 5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- E. Material Preparation:
- 1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
  - 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
- F. Exposed Surfaces: Include areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
- 1. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  - 2. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
  - 3. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
  - 4. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
  - 5. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
- G. Sand lightly between each succeeding enamel or varnish coat.

- H. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
  - 1. Omit primer over metal surfaces that have been shop primed and touchup painted.
  - 2. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance.
- I. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
- J. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide total dry film thickness of the entire system as recommended by manufacturer.
- K. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and occupied spaces.
- L. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
- M. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.
- N. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- O. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.
- P. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

### 3.2 CLEANING AND PROTECTING

- A. At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.
- B. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.

- C. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
  - 1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

### 3.3 EXTERIOR PAINT SCHEDULE

- A. Concrete, Stucco, and Masonry (Other Than Concrete Unit Masonry):
  - 1. Acrylic Finish: Two finish coats over a primer.
    - a. Primer: Exterior concrete and masonry primer.
    - b. Finish Coats: Exterior low-luster acrylic paint.
- B. Concrete Unit Masonry:
  - 1. Acrylic Finish: Two finish coats over a block filler.
    - a. Block Filler: Concrete unit masonry block filler.
    - b. Finish Coats: Exterior low-luster acrylic paint.
- C. Ferrous Metal:
  - 1. Acrylic Finish: Two finish coats over a rust-inhibitive primer.
    - a. Primer: Exterior ferrous-metal primer (not required on shop-primed items).
    - b. Finish Coats: Exterior semigloss acrylic enamel.
- D. Zinc-Coated Metal:
  - 1. Acrylic Finish: Two finish coats over a galvanized metal primer.
    - a. Primer: Exterior galvanized metal primer.
    - b. Finish Coats: Exterior semigloss acrylic enamel.

### 3.4 INTERIOR PAINT SCHEDULE

- A. Concrete and Masonry (Other Than Concrete Unit Masonry):
  - 1. Acrylic Finish: Two finish coats over a primer.
    - a. Primer: Interior concrete and masonry primer.
    - b. Finish Coats: Interior low-luster acrylic enamel.
  - 2. Alkyd-Enamel Finish: Two finish coats over a primer.
    - a. Primer: Interior concrete and masonry primer.
    - b. Finish Coats: Interior semigloss alkyd enamel.

B. Concrete Unit Masonry:

1. Acrylic Finish: Two finish coats over a block filler.
  - a. Block Filler: Concrete unit masonry block filler.
  - b. Finish Coats: Interior low-luster acrylic enamel.
2. Alkyd-Enamel Finish: Two finish coats over a filled surface.
  - a. Block Filler: Concrete unit masonry block filler.
  - b. Finish Coat: Interior semigloss alkyd enamel.

C. Mineral-Fiber-Reinforced Cement Panels:

1. Flat Acrylic Finish: Two finish coats.
  - a. Finish Coats: Interior flat acrylic paint.

D. Gypsum Board:

1. Acrylic Finish: Two finish coats over a primer.
  - a. Primer: Interior gypsum board primer.
  - b. Finish Coats: Interior low-luster acrylic enamel.
2. Alkyd-Enamel Finish: Two finish coats over a primer.
  - a. Primer: Interior gypsum board primer.
  - b. Finish Coats: Interior semigloss alkyd enamel.

E. Wood and Hardboard:

1. Acrylic-Enamel Finish: Two finish coats over a primer.
  - a. Primer: Interior wood primer for acrylic-enamel and semigloss alkyd-enamel finishes.
  - b. Finish Coats: Interior low-luster acrylic enamel.
2. Alkyd-Enamel Finish: Two finish coats over a primer.
  - a. Primer: Interior wood primer for acrylic-enamel and semigloss alkyd-enamel finishes.
  - b. Finish Coats: Interior semigloss alkyd enamel.

F. Ferrous Metal:

1. Alkyd-Enamel Finish: Two finish coats over a primer.
  - a. Primer: Interior ferrous-metal primer.
  - b. Finish Coats: Interior semi-gloss alkyd enamel.

G. All-Service Jacket over Insulation:

1. Acrylic Finish: Two finish coats. Add fungicidal agent to render fabric mildew proof.
  - a. Finish Coats: Interior flat latex-emulsion size.

### 3.5 INTERIOR STAIN AND NATURAL-FINISH WOODWORK SCHEDULE

- A. Stain-Varnish Finish: Two finish coats of varnish over a sealer coat and interior wood stain. Wipe wood filler before applying stain.
  1. Filler Coat: Open-grain wood filler.
  2. Stain Coat: Interior wood stain.
  3. Sealer Coat: Clear sanding sealer.
  4. Finish Coats: Interior alkyd- or polyurethane-based clear satin varnish.
- B. Natural-Varnish Finish: Two finish coats of varnish over a sealer coat and a filler coat.
  1. Filler Coat: Open-grain wood filler.
  2. Sealer Coat: Clear sanding sealer.
  3. Finish Coats: Interior alkyd- or polyurethane-based clear satin varnish.
- C. Wax-Polished Finish: Three finish coats of paste wax over a sealer coat and alkyd-based interior wood stain.
  1. Stain Coat: Interior wood stain.
  2. Sealer Coat: Clear sanding sealer.
  3. Finish Coats: Paste wax.

END OF SECTION 099120



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## SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section Includes:
  - 1. Public-use washroom accessories.
  - 2. Warm-air dryers.
  - 3. Childcare accessories.

## 1.3 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

## 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
  - 2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
  - 3. Include electrical characteristics.

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## 2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.
- B. Toilet Tissue (Roll) Dispenser:
  - 1. Manufacturer:
    - a. Bobrick: B-2740.
  - 2. Description: Roll-in-reserve dispenser with hinged front secured with tumbler lockset.
  - 3. Mounting: Surface mounted.
  - 4. Operation: Noncontrol delivery with theft-resistant spindle.
  - 5. Capacity: Designed for 4-1/2- or 5-inch- (114- or 127-mm-) diameter tissue rolls.
  - 6. Material and Finish: Stainless steel, No. 4 finish (satin).
- C. Combination Towel (Folded) Dispenser/Waste Receptacle:
  - 1. Manufacturer:
    - a. Bobrick: B-35903.
  - 2. Description: Recessed Paper Towel Dispenser
  - 3. Mounting: Recessed.
    - a. Designed for nominal 4-inch (100-mm) wall depth.
  - 4. Minimum Towel-Dispenser Capacity: 350 C-fold or 475 multifold paper towels.
  - 5. Minimum Waste-Receptacle Capacity: 3 gal. (11.3 L).
  - 6. Material and Finish: Stainless steel, No. 4 finish (satin).
  - 7. Liner: Reusable, vinyl waste-receptacle liner.
  - 8. Lockset: Tumbler type for towel-dispenser compartment.
- D. Automatic Liquid-Soap Dispenser:
  - 1. Manufacturer:
    - a. As indicated on the Drawings.
  - 2. Description: Automatic dispenser with infrared sensor to detect presence of hands; battery powered; designed for dispensing soap in liquid or lotion form.
  - 3. Mounting: Deck mounted on vanity or deck mounted on lavatory.
  - 4. Capacity: 27 oz. (800 mL).
  - 5. Refill Indicator: LED indicator.
  - 6. Low Battery Indicator: LED indicator.
- E. Grab Bar:
  - 1. Manufacturer:

- a. As indicated on the Drawings.
  2. Mounting: Flanges with concealed fasteners.
  3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.
    - a. Finish: Smooth, No. 4 finish (satin).
  4. Outside Diameter: 1-1/2 inches (38 mm).
  5. Configuration and Length: As indicated on Drawings.
- F. Sanitary-Napkin Disposal Unit:
1. Manufacturer:
    - a. Bobrick: B-254
  2. Mounting: Surface mounted.
  3. Door or Cover: Self-closing, disposal-opening cover.
  4. Receptacle: Removable.
  5. Material and Finish: Stainless steel, No. 4 finish (satin).
- G. Seat-Cover Dispenser:
1. Manufacturer:
    - a. As indicated on the Drawings.
  2. Mounting: Recessed.
  3. Minimum Capacity: 500 seat covers.
  4. Exposed Material and Finish: Stainless steel, No. 4 finish (satin).
  5. Lockset: Tumbler type.

## 2.3 WARM-AIR DRYERS

- A. High-Speed Warm-Air Dryer:
1. Manufacturer:
    - a. Not used.
  2. Description: High-speed, warm-air hand dryer for rapid hand drying.
  3. Mounting: Surface mounted.
  4. Cover Material and Finish: Steel, with white enamel finish.
  5. Electrical Requirements: 115 V, 13 A, 1500 W.

## 2.4 CHILDCARE ACCESSORIES

- A. Diaper-Changing Station:
1. Manufacturer:

2. As indicated on the Drawings.
3. Description: Horizontal unit that opens by folding down from stored position and with child-protection strap.
  - a. Engineered to support minimum of **250-lb (113-kg)** static load when opened.
4. Mounting: Semirecessed, with unit projecting not more than **1 inch (25 mm)** from wall when closed.
5. Operation: By pneumatic shock-absorbing mechanism.
6. Material and Finish: Stainless steel, No. 4 finish (satin), exterior shell with rounded plastic corners; HDPE interior in manufacturer's standard color.
7. Liner Dispenser: Built in.

## 2.5 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, **0.031-inch (0.8-mm)** minimum nominal thickness unless otherwise indicated.
- B. Brass: ASTM B 19, flat products; ASTM B 16/B 16M, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
- C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), **0.036-inch (0.9-mm)** minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with **G60 (Z180)** hot-dip zinc coating.
- E. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.

## 2.6 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least **250 lbf (1112 N)**, when tested according to ASTM F 446.

### 3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written instructions.

END OF SECTION 102800

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## SECTION 104413 - FIRE PROTECTION CABINETS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section Includes:
  - 1. Fire-protection cabinets for the following:
    - a. Portable fire extinguishers.
- B. Related Requirements:
  - 1. Section 104416 "Fire Extinguishers."
  - 2. Section 211200 "Fire-Suppression Standpipes" for fire-hose connections.

## 1.3 PREINSTALLATION CONFERENCE

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review methods and procedures related to fire-protection cabinets including, but not limited to, the following:
    - a. Schedules and coordination requirements.

## 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed, semi-recessed-, or surface-mounting method and relationships of box and trim to surrounding construction.
- B. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each type of exposed finish required.
- D. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semi-recessed, or surface mounted. Coordinate final fire-protection cabinet schedule with



fire-extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

#### 1.6 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

#### 1.7 SEQUENCING

- A. Apply vinyl lettering on field-painted fire-protection cabinets after painting is complete.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

#### 2.2 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. JL Industries, Inc.; a division of the Activar Construction Products Group; Panorama Series.
    - b. Larsens Manufacturing Company; Gemini Series.
- B. Cabinet Construction: Cabinet rating shall match the rating of wall of which it is installed.
  - 1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch- (1.09-mm-) thick cold-rolled steel sheet lined with minimum 5/8-inch- (16-mm-) thick fire-barrier material. Provide factory-drilled mounting holes.
- C. Cabinet Material: Cold-rolled steel sheet.

- D. Recessed Cabinet: Exposed Flat Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
- E. Semi-recessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
  - 1. Rolled-Edge Trim: 2-1/2-inch (64-mm) backbend depth.
- F. Surface-Mounted Cabinet: Cabinet box fully exposed and mounted directly on wall with no trim.
- G. Cabinet Trim Material: Stainless-steel sheet, unless otherwise noted on Drawings to be painted.
- H. Door Material: Match cabinet trim material.
- I. Door Style: Fully glazed, frameless, backless, acrylic panel.
- J. Door Glazing: Acrylic sheet.
  - 1. Acrylic Sheet Color: Clear transparent acrylic sheet.
- K. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
  - 1. Provide manufacturer's standard.
  - 2. Provide manufacturer's standard hinge permitting door to open 180 degrees.
- L. Accessories:
  - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, as required for sizes, types, and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
  - 2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location.
    - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
      - 1) Location: Applied to cabinet glazing.
      - 2) Application Process: Pressure-sensitive vinyl letters.
      - 3) Lettering Color: Red.
      - 4) Orientation: Vertical.
- M. Materials:
  - 1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
    - a. Finish: Factory primed for field painting.

2. Stainless Steel: ASTM A 666, Type 304.
  - a. Finish: No. 4 directional satin finish.
3. Transparent Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), 3/16-inch (4.76 mm) thick, with Finish 1 (smooth or polished).

## 2.3 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
  1. Weld joints and grind smooth.
  2. Provide factory-drilled mounting holes.
  3. Prepare doors and frames to receive locks.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
  1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch (13 mm) thick.
  2. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

## 2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining 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 walls and partitions for suitable framing depth and blocking where recessed and semi-recessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Prepare recesses for recessed and semi-recessed fire-protection cabinets as required by type and size of cabinet and trim style.

### 3.3 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
  - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semi-recessed fire-protection cabinets.
  - 2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

### 3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

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## SECTION 104416 - FIRE EXTINGUISHERS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers.
- B. Related Requirements:
  - 1. Section 104413 "Fire Protection Cabinets."

## 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher.
- B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.

## 1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

## 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

## 1.6 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

## 1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Failure of hydrostatic test according to NFPA 10.
    - b. Faulty operation of valves or release levers.
  - 2. Warranty Period: Six years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

### 2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet indicated.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Amerex Corporation.
    - b. Ansul Incorporated; Tyco International.
    - c. Fire End & Croker Corporation.
    - d. JL Industries, Inc.; a division of the Activar Construction Products Group.
    - e. Larsens Manufacturing Company.
  - 2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
- B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:60-B:C, 10-lb (4.5-kg) nominal capacity, with mono-ammonium phosphate-based dry chemical in enameled-steel container.

### 2.3 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Amerex Corporation.
  - b. Ansul Incorporated; Tyco International.
  - c. Fire End & Croker Corporation.
  - d. JL Industries, Inc.; a division of the Activar Construction Products Group.
  - e. Larsens Manufacturing Company.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
  1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
    - a. Orientation: Vertical.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
  1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416



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## SECTION 105300 – PREFABRICATED METAL CANOPIES.

## PART 1 - GENERAL

- 1.1 Work in this section includes furnishing and installation of all extruded aluminum sunshades with custom designed cantilever support brackets as manufactured by Mapes Industries Inc.

## 1.2 RELATED ITEMS AND CONSIDERATIONS

- A. Flashing of various designs may be required. Generic flashing supplied by Mapes. Specialty flashing to be supplied by installer.
- B. Determine wall construction, make-up and thickness.
- C. Ensure adequate wall condition to carry canopy loads where required
- D. Consider water drainage away from area where necessary
- E. Any necessary removal or relocation of existing structures, obstructions or materials

## 1.3 QUALITY ASSURANCE

- A. Products meeting these specifications establish standards of quality required as manufactured by Mapes Industries, Inc. Lincoln, Nebraska, 1-888-273-1132

## 1.4 FIELD MEASUREMENT

- A. Confirm dimensions prior to preparation of shop drawings when possible.
- B. If requested, supply manufacturer's standard literature and specifications for canopies.
- C. Submit shop drawings showing structural component locations/positions, material dimensions and details of construction and assembly.

## 1.5 PERFORMANCE REQUIREMENTS

- A. Sunshades must conform to local building codes..
- B. PE Stamped calculations are available if specified and per project location.
- C. PE stamped calculations must be signed and sealed by an engineer licensed within the state the sunshades are installed.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store all canopy components in protected areas.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURER

- A. Mapes Canopies, Lincoln, Nebraska . Phone: 1-888-273-1132. Fax: 1-877-455-

### 2.2 MATERIALS

- A. Decking shall consist of 3" extruded flat soffit .078 decking.
- B. Intermediate framing members shall be extruded aluminum, alloy 6063-T6, in profile and thickness shown in current Mapes brochures.
- C. Cantilever support brackets shall be design engineered per application.
- D. Cantilever support brackets will have standard available finishes
- E. Fascia shall be extruded 12" C-channel style.

### 2.3 FINISHES

- A. Finish type shall be premium finish option.

### 2.4 FABRICATION

- A. All Mapes SuperShade sunshades are shipped in preassembled sections for ease of installation
- B. All connections shall be mechanically assembled utilizing 3/16 fasteners with a minimum shear stress of 350 lb. Pre-welded or factory-welded connections are not acceptable.
- C. Concealed drainage. Water shall drain from covered surfaces into intermediate trough and be directed to Downspout From Fascia.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Confirm that surrounding area is ready for the sunshade installation.

- B. Installer shall confirm dimensions and elevations to be as shown on drawings provided by Mapes Industries.
- C. Erection shall be performed by an approved installer and scheduled after all concrete, masonry and roofing in the area is completed.

### 3.2 INSTALLATION

- A. Installation shall be in strict accordance with manufacturer's shop drawings. Particular attention should be given to protecting finish during handling and erection.
- B. After Installation, entire system shall be left in a clean condition.

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## SECTION 14 24 00 HYDRAULIC PASSENGER ELEVATORS

## PART 1 GENERAL

## 1.01 SUMMARY

- A. Section includes: Hydraulic passenger elevators as shown and specified. Elevator work includes:
  - 1. Standard pre-engineered hydraulic passenger elevators.
  - 2. Elevator car enclosures, hoistway entrances and signal equipment.
  - 3. Operation and control systems.
  - 4. Jack(s).
  - 5. Accessibility provisions for physically disabled persons.
  - 6. Equipment, machines, controls, systems and devices as required for safely operating the specified elevators at their rated speed and capacity.
  - 7. Materials and accessories as required to complete the elevator installation.
- B. Related Sections:
  - 1. Division 1 General Requirements: Meet or exceed all referenced sustainability requirements.
  - 2. Division 3 Concrete: Installing inserts, sleeves and anchors in concrete.
  - 3. Division 4 Masonry: Installing inserts, sleeves and anchors in masonry.
  - 4. Division 5 Metals:
    - a. Providing hoist beams, pit ladders, steel framing, auxiliary support steel and divider beams for supporting guide-rail brackets.
    - b. Providing steel angle sill supports and grouting hoistway entrance sills and frames.
  - 5. Division 9 Finishes: Providing elevator car finish flooring and field painting unfinished and shop primed ferrous materials.
  - 6. Division 16 Sections:
    - a. Providing electrical service to elevators, including fused disconnect switches.
    - b. Emergency power supply, transfer switch and auxiliary contacts.
    - c. Heat and smoke sensing devices.
    - d. Convenience outlets and illumination in control room, hoistway and pit.
  - 7. Division 22 Plumbing
    - a. Sump pit and oil interceptor.
  - 8. Division 23 Heating, Ventilation and Air Conditioning
    - a. Heating and ventilating hoistways and/or control room.
- C. Work Not Included: General contractor shall provide the following in accordance with the requirements of the Model Building Code and ANSI A17.1 Code. For specific rules, refer to ANSI A17.1, Part 3 for hydraulic elevators. State or local requirements must be used if more stringent. The cost of this work is not included in the thyssenkrupp Elevator's proposal, since it is a part of the building construction.

1. Elevator hoist beam to be provided at top of elevator shaft. Beam must be able to accommodate proper loads and clearances for elevator installation and operation.
2. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports and bracing including all setting templates and diagrams for placement.
3. Hatch walls require a minimum two hours of fire rating. Hoistway should be clear and plumb with variations not to exceed 1/2" at any point.
4. Elevator hoistways shall have barricades, as required.
5. Install bevel guards at 75° on all recesses, projections or setbacks over 2" (4" for A17.1 2000 areas) except for loading or unloading.
6. Provide rail bracket supports at pit, each floor and roof. For guide rail bracket supports, provide divider beams between hoistway at each floor and roof.
7. Pit floor shall be level and free of debris. Reinforce dry pit to sustain normal vertical forces from rails and buffers.
8. Where pit access is by means of the lowest hoistway entrance, a vertical ladder of non-combustible material extending 42" minimum, (48" minimum for A17.1-2000 areas) shall be provided at the same height, above sill of access door or handgrips.
9. Machine room to be enclosed and protected.
10. Machine Room temperature must be maintained between 55° and 90° F.
11. If machine room is remote from the elevator hoistway, clear access must be available above the ceiling or metal/concrete raceways in floor for oil line and wiring duct from machine room.
12. Access to the machinery space and machine room must be in accordance with the governing authority or code.
13. Provide an 8" x 16" cutout through machine room wall, for oil line and wiring duct, coordinated with elevator contractor at the building site.
14. All wire and conduit should run remote from the hoistways.
15. When heat, smoke or combustion sensing devices are required, connect to elevator control cabinet terminals. Contacts on the sensors should be sided for 12 volt D.C.
16. Install and furnish finished flooring in elevator cab.
17. Finished floors and entrance walls are not to be constructed until after sills and door frames are in place. Consult elevator contractor for rough opening size. The general contractor shall supply the drywall framing so that the wall fire resistance rating is maintained, when drywall construction is used.
18. Where sheet rock or drywall construction is used for front walls, it shall be of sufficient strength to maintain the doors in true lateral alignment. Drywall contractor to coordinate with elevator contractor.
19. Before erection of rough walls and doors; erect hoistway sills, headers, and frames. After rough walls are finished; erect fascias and toe guards. Set sill level and slightly above finished floor at landings.

20. To maintain legal fire rating (masonry construction), door frames are to be anchored to walls and properly grouted in place.
21. The elevator wall shall interface with the hoistway entrance assembly and be in strict compliance with the elevator contractor's requirements.
22. General Contractor shall fill and grout around entrances, as required.
23. Elevator sill supports shall be provided at each opening.
24. All walls and sill supports must be plumb where openings occur.
25. For applications with jack hole, free and clear access to the elevator pit area for the jack hole-drilling rig is required.
26. Where jack hole is required, remove all spoils from jack hole drilling.
27. When not provided by Elevator Contractor, jack hole shall accommodate the jack unit. If required the jack hole is to be provided in strict accordance with the elevator contractor's shop drawings.
28. Locate a light fixture (200 lx / 19 fc) and convenience outlet in pit with switch located adjacent to the access door.
29. A light switch and fused disconnect switch for each elevator should be located inside the machine room adjacent to the door, where practical, per the National Electrical Code (NFPA No. 70).
30. For signal systems and power operated door: provide ground and branch wiring circuits, including main line switch.
31. For car light and fan: provide a feeder and branch wiring circuits, including main line switch.
32. Wall thickness may increase when fixtures are mounted in drywall. These requirements must be coordinated between the general contractor and the elevator contractor.
33. Provide supports, patching and recesses to accommodate hall button boxes, signal fixtures, etc..
34. Locate telephone and convenience outlet on control panel.

## 1.02 SUBMITTALS

- A. Product data: When requested, the elevator contractor shall provide standard cab, entrance and signal fixture data to describe product for approval.
- B. Shop drawings:
  1. Show equipment arrangement in the corridor, pit, and hoistway and/or optional control room. Provide plans, elevations, sections and details of assembly, erection, anchorage, and equipment location.
  2. Indicate elevator system capacities, sizes, performances, safety features, finishes and other pertinent information.
  3. Show floors served, travel distances, maximum loads imposed on the building structure at points of support and all similar considerations of the elevator work.
  4. Indicate electrical power requirements and branch circuit protection device recommendations.



- C. Powder Coat paint selection: Submit manufacturer's standard selection charts for exposed finishes and materials.
- D. Plastic laminate selection: Submit manufacturer's standard selection charts for exposed finishes and materials.
- E. Metal Finishes: Upon request, standard metal samples provided.
- F. Operation and maintenance data. Include the following:
  - 1. Owner's manuals and wiring diagrams.
  - 2. Parts list, with recommended parts inventory.

### 1.03 QUALITY ASSURANCE

- A. Manufacturer Qualifications: An approved manufacturer with minimum 15 years of experience in manufacturing, installing, and servicing elevators of the type required for the project.
  - 1. The manufacturer of machines, controllers, signal fixtures, door operators cabs, entrances, and all other major parts of elevator operating equipment.
    - a. The major parts of the elevator equipment shall be manufactured by the installing company, and not be an assembled system.
  - 2. The manufacturer shall have a documented, on-going quality assurance program.
  - 3. ISO-9001:2000 Manufacturer Certified
  - 4. ISO-14001:2004 Environmental Management System Certified
  - 5. LEED Gold certified elevator manufacturing facility.
- B. Installer Qualifications: The manufacturer or an authorized agent of the manufacturer with not less than 15 years of satisfactory experience installing elevators equal in character and performance to the project elevators.
- C. Regulatory Requirements:
  - 1. ASME A17.1 Safety Code for Elevators and Escalators, latest edition or as required by the local building code.
  - 2. Building Code: National.
  - 3. NFPA 70 National Electrical Code.
  - 4. NFPA 80 Fire Doors and Windows.
  - 5. Americans with Disabilities Act - Accessibility Guidelines (ADAAG)
  - 6. Section 407 in ICC A117.1, when required by local authorities
  - 7. CAN/CSA C22.1 Canadian Electrical Code
  - 8. CAN/CSA B44 Safety Code for Elevators and Escalators.
  - 9. California Department of Public Health Standard Method V1.1–2010, CA Section 01350

- D. Fire-rated entrance assemblies: Opening protective assemblies including frames, hardware, and operation shall comply with ASTM E2074, CAN4-S104 (ULC-S104), UL10(b), and NFPA Standard 80. Provide entrance assembly units bearing Class B or 1 1/2 hour label by a Nationally Recognized Testing Laboratory (2 hour label in Canada).
- E. Inspection and testing:
  - 1. Elevator Installer shall obtain and pay for all required inspections, tests, permits and fees for elevator installation.
  - 2. Arrange for inspections and make required tests.
  - 3. Deliver to the Owner upon completion and acceptance of elevator work.
- F. Sustainable Product Qualifications:
  - 1. Environmental Product Declaration:
    - a. GOOD: If Product Category Rules (PCR) are not available, produce a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that has at least a cradle to gate scope.
    - b. BEST: If Product Category Rules (PCR) are available, produce and publish an Environmental Product Declaration (EPD) based on a critically reviewed life-cycle assessment conforming to ISO 14044, with external verification recognized by the EPD program operator.
  - 2. Material Transparency:
    - a. GOOD: Provide Health Product Declaration at any level
    - b. BETTER: Provide Health Product Declaration (HPD v2 or later). Complete, published declaration with full disclosure of known hazards, prepared using the Health Product Declaration Collaborative's "HPD builder" on-line tool.
    - c. BEST: Cradle to Cradle Material Health Certificate v3, Bronze level or higher.
  - 3. LEED v4 – Provide documentation for all Building Product Disclosure AND Optimization credits in LEED v4 for product specified.
  - 4. Living Building Challenge Projects: Provide Declare label for products specified.

#### 1.04 DELIVERY, STORAGE AND HANDLING

- A. Manufacturing shall deliver elevator materials, components and equipment and the contractor is responsible to provide secure and safe storage on job site.

#### 1.05 PROJECT CONDITIONS

- A. Temporary Use: Elevators shall not be used for temporary service or for any other purpose during the construction period before Substantial Completion and acceptance by the purchaser unless agreed upon by Elevator Contractor and General Contractor with signed temporary agreement.

- B. Provide the hole for the jack unit (if required by the type of jack provided), based on excavation through normal soil or clay which can be removed by manual digging or by standard truck-mounted regular drilling unit. Provide a casing if required to retain the walls of the hole. General contractor shall remove excavation spoils deposited in the elevator pit.
  - 1. If a physical obstruction or hindrance is encountered below the ground surface, including boulders, rock, gravel, wood, metal, pilings, sand, water, quick sand, caves, public utilities or any other foreign material, obtain written authorization to proceed with excavating using special excavation equipment.
  - 2. Maintain a daily log of time and material costs involved.
  - 3. Elevator contractor will be compensated on a time and material basis for additional costs incurred after encountering the physical obstruction or hindrance, including the cost of the special excavation equipment.

#### 1.06 WARRANTY

- A. Warranty: Submit elevator manufacturer's standard written warranty agreeing to repair, restore or replace defects in elevator work materials and workmanship not due to ordinary wear and tear or improper use or care for 12 months after final acceptance.

#### 1.07 MAINTENANCE

- A. Furnish maintenance and call back service for a period of 3 months for each elevator after completion of installation or acceptance thereof by beneficial use, whichever is earlier, during normal working hours excluding callbacks.
  - 1. Service shall consist of periodic examination of the equipment, adjustment, lubrication, cleaning, supplies and parts to keep the elevators in proper operation. Maintenance work, including emergency call back repair service, shall be performed by trained employees of the elevator contractor during regular working hours.
  - 2. Submit parts catalog and show evidence of local parts inventory with complete list of recommended spare parts. Parts shall be produced by manufacturer of original equipment.
  - 3. Manufacturer shall have a service office and full time service personnel within a 100 mile radius of the project site.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Manufacturer: Design based around Genesis Elevator - Vertical Express Elevator's endura hydraulic elevator.

#### 2.02 MATERIALS, GENERAL

- A. All Elevator Cab materials including frame, buttons, lighting, wall and ceiling assembly, laminates and carpet shall have an EPD and an HPD, and shall meet the California Department of Public Health Standard Method V1.1–2010, CA Section 01350 as mentioned in 1.03.9 of this specification.
- B. Colors, patterns, and finishes: As selected by the Architect from manufacturer's full range of standard colors, patterns, and finishes.
- C. Steel:
  - 1. Shapes and bars: Carbon.
  - 2. Sheet: Cold-rolled steel sheet, commercial quality, Class 1, matte finish.
  - 3. Finish: Factory-applied baked enamel for structural parts, powder coat for architectural parts. Color selection must be based on elevator manufacture's standard selections.
- D. Plastic laminate: Decorative high-pressure type, complying with NEMA LD3, Type GP-50 General Purpose Grade, nominal 0.050" thickness. Laminate selection must be based on elevator manufacture's standard selections.
- E. Flooring by others.

## 2.03 HOISTWAY EQUIPMENT

- A. Platform: Fabricated frame of formed or structural steel shapes, gusseted and rigidly welded with a wood sub-floor. Underside of the platform shall be fireproofed. The car platform shall be designed and fabricated to support one-piece loads weighing up to 25% of the rated capacity.
- B. Sling: Steel stiles bolted or welded to a steel crosshead and bolstered with bracing members to remove strain from the car enclosure.
- C. Guide Rails: Steel, omega shaped, fastened to the building structure with steel brackets.
- D. Guides: Slide guides shall be mounted on top and bottom of the car.
- E. Buffers: Provide substantial buffers in the elevator pit. Mount buffers on continuous channels fastened to the elevator guide rail or securely anchored to the pit floor. Provide extensions if required by project conditions.
- F. Jack: A jack unit shall be of sufficient size to lift the gross load the height specified. Factory test jack to ensure adequate strength and freedom from leakage. Brittle material, such as gray cast iron, is prohibited in the jack construction. Provide the following jack type: Twin post Holeless 2 stage. Two jacks piped together, mounted one on each side of the car with each having three telescopic sections designed to extend in a synchronized manner when oil is pumped into the assembly. Each jack section will be guided

from within the casing or the plunger assembly used to house the section. Each plunger shall have a high pressure sealing system which will not allow for seal movement or displacement during the course of operation. A follower guide shall be furnished for the top of the lower two plungers and be guided by rollers running inside a steel guide channel which is firmly attached to the guide rail system. This plunger guide system shall maintain a stabilized support for the plunger sections. Each jack assembly shall have check valves built into the assembly to allow for automatically re-syncing the three plunger sections by moving the jack to its fully contracted position..

- G. Automatic Self-Leveling: Provide each elevator car with a self-leveling feature to automatically bring the car to the floor landings and correct for over travel or under travel. Self-leveling shall, within its zone, be automatic and independent of the operating device. The car shall be maintained approximately level with the landing irrespective of its load.

Wiring, Piping, and Oil: Provide all necessary hoistway wiring in accordance with the National Electrical Code. All necessary code compliant pipe and fittings shall be provided to connect the power unit to the jack unit.

## 2.04 POWER UNIT

- A. Power Unit (Oil Pumping and Control Mechanism): A self-contained unit consisting of the following items:
  - 1. An oil reservoir with tank cover.
  - 2. An oil hydraulic pump.
  - 3. An electric motor.
  - 4. An oil control valve with the following components built into single housing; high pressure relief valve, check valve, automatic unloading up start valve, lowering and leveling valve, and electro-magnetic controlling solenoids.
- B. Pump: Positive displacement type pump specifically manufactured for oil-hydraulic elevator service. Pump shall be designed for steady discharge with minimum pulsation to give smooth and quiet operation. Output of pump shall not vary more than 10 percent between no load and full load on the elevator car.
- C. Motor: Standard manufacture motor specifically designed for oil-hydraulic elevator service. Duty rating shall be selected for specified speed and load.
- D. Oil Control Unit: The following components shall be built into a single housing. Welded manifolds with separate valves to accomplish each function are not acceptable. Adjustments shall be accessible and be made without removing the assembly from the oil line.
  - 1. Relief valve shall be adjustable and be capable of bypassing the total oil flow without increasing back pressure more than 10 percent above that required to barely open the valve.

2. Up start and stop valve shall be adjustable and designed to bypass oil flow during start and stop of motor pump assembly. Valve shall close slowly, gradually diverting oil to or from the jack unit, ensuring smooth up starts and up stops.
3. Check valve shall be designed to close quietly without permitting any perceptible reverse flow.
4. Lowering valve and leveling valve shall be adjustable for down start speed, lowering speed, leveling speed and stopping speed to ensure smooth "down" starts and stops. The leveling valve shall be designed to level the car to the floor in the direction the car is traveling after slowdown is initiated.
5. Provided with constant speed regulation in both up and down direction. Feature to compensate for load changes, oil temperature, and viscosity changes.
6. Solid State Starting: Provide an electronic starter featuring adjustable starting currents.
7. Oil Type: Provide a zinc free, inherently biodegradable lubricant formulated with premium base stocks to provide outstanding protection for demanding hydraulic systems, especially those operating in environmentally sensitive areas.

## 2.05 HOISTWAY ENTRANCES

- A. Doors and Frames: Provide complete hollow metal type hoistway entrances at each hoistway opening bolted\knock down construction.
  1. Manufacturer's standard entrance design consisting of hangers, doors, hanger supports, hanger covers, fascia plates (where required), sight guards, and necessary hardware.
  2. Main landing door & frame finish: Stainless steel panels, no. 4 brushed finish.
  3. Typical door & frame finish: Stainless steel panels, No. 4 brushed finish.
- B. Interlocks: Equip each hoistway entrance with an approved type interlock tested as required by code. Provide door restriction devices as required by code.
- C. Door Hanger and Tracks: Provide sheave type two point suspension hangers and tracks for each hoistway horizontal sliding door.
  1. Sheaves: Polyurethane tires with ball bearings properly sealed to retain grease.
  2. Hangers: Provide an adjustable device beneath the track to limit the up-thrust of the doors during operation.
  3. Tracks: Drawn steel shapes, smooth surface and shaped to conform to the hanger sheaves.
- D. Hoistway Sills: Extruded metal, with groove(s) in top surface. Provide mill finish on aluminum.

## 2.06 PASSENGER ELEVATOR CAR ENCLOSURE

## A. Car Enclosure:

1. Walls: TBD
2. Reveals and frieze: Stainless steel, No. 4 brushed finish
3. Canopy: Cold-rolled steel with hinged exit.
4. Ceiling: Downlight type, metal pans with suspended LED downlights and dimmer switch. Number of downlights shall be dependent on platform size with a minimum of six. The metal pans shall be finished with a stainless steel, no. 4 brushed finish.
5. Cab Fronts, Return, Transom, Soffit and Strike: Provide panels faced with No. 4 brushed stainless steel
6. Doors: Horizontal sliding car doors reinforced with steel for panel rigidity. Hang doors on sheave type hangers with polyurethane tires that roll on a polished steel track and are guided at the bottom by non-metallic sliding guides.
  - a. Door Finish: Stainless steel panels: No. 4 brushed finish.
  - b. Cab Sills: Extruded aluminum, mill finish.
7. Handrail: Provide 1.5" diameter cylindrical metal on rear walls on front opening cars and side walls only on front and rear opening cars. Handrails shall have a stainless steel, No. 4 brushed finish.
8. Ventilation: Manufacturer's standard exhaust fan, mounted on the car top.
9. Protection pads and buttons: Provide one set of vinyl protection pads with metal grommets for the project. Provide pad buttons on cab front(s) and walls.

- B. Car Top Inspection: Provide a car top inspection station with an "Auto-Inspection" switch, an "emergency stop" switch, and constant pressure "up and down" direction and safety buttons to make the normal operating devices inoperative. The station shall give the inspector complete control of the elevator. The car top inspection station shall be mounted in the door operator assembly.

## 2.07 DOOR OPERATION

- A. Door Operation: Provide a direct or alternating current motor driven heavy duty operator designed to operate the car and hoistway doors simultaneously. The door control system shall be digital closed loop and the closed loop circuit shall give constant feedback on the position and velocity of the elevator door. The motor torque shall be constantly adjusted to maintain the correct door speed based on its position and load. All adjustments and setup shall be through the computer-based service tool. Door movements shall follow a field programmable speed pattern with smooth acceleration and deceleration at the ends of travel. The mechanical door operating mechanism shall be arranged for manual operation in event of power failure. Doors shall automatically open when the car arrives at the landing and automatically close after an adjustable time interval or when the car is dispatched to another landing. AC controlled units with oil checks, or other deviations are not acceptable.

1. No Un-Necessary Door Operation: The car door shall open only if the car is stopping for a car or hall call, answering a car or hall call at the present position or selected as a dispatch car.
  2. Door Open Time Saver: If a car is stopping in response to a car call assignment only (no coincident hall call), the current door hold open time is changed to a shorter field programmable time when the electronic door protection device is activated.
  3. Double Door Operation: When a car stops at a landing with concurrent up and down hall calls, no car calls, and no other hall call assignments, the car door opens to answer the hall call in the direction of the car's current travel. If an on-ward car call is not registered before the door closes to within 6 inches of fully closed, the travel shall reverse, and the door shall reopen to answer the other call.
  4. Nudging Operation: The doors shall remain open as long as the electronic detector senses the presence of a passenger or object in the door opening. If door closing is prevented for a field programmable time, a buzzer shall sound. When the obstruction is removed, the door shall begin to close at reduced speed. If the infra-red door protection system detects a person or object while closing on nudging, the doors shall stop and resume closing only after the obstruction has been removed.
  5. Door Reversal: If the doors are closing and the infra-red beam(s) is interrupted, the doors shall reverse and reopen. After the obstruction is cleared, the doors shall begin to close.
  6. Door Open Watchdog: If the doors are opening, but do not fully open after a field adjustable time, the doors shall recycle closed then attempt to open six times to try and correct the fault.
  7. Door Close Watchdog: If the doors are closing, but do not fully close after a field adjustable time, the doors shall recycle open then attempt to close six times to try and correct the fault.
  8. Door Close Assist: When the doors have failed to fully close and are in the recycle mode, the door drive motor shall have increased torque applied to possibly overcome mechanical resistance or differential air pressure and allow the door to close.
- B. Door Protection Device: Provide a door protection system using microprocessor controlled infra-red light beams. The beams shall project across the car opening detecting the presence of a passenger or object. If door movement is obstructed, the doors shall immediately reopen.

## 2.08 CAR OPERATING STATION

- A. Car Operating Station, General: The main car control in each car shall contain the devices required for specific operation mounted in an integral swing return panel requiring no applied faceplate. Wrap return shall have a No. 4 brushed stainless steel finish. The



main car operating panel shall be mounted in the return and comply with handicap requirements. Pushbuttons that illuminate using long lasting LED's shall be included for each floor served, and emergency buttons and switches shall be provided per code. Switches for car light and accessories shall be provided.

- B. Emergency Communications System: Integral phone system provided.
- C. Auxiliary Operating Panel: Not Required
- D. Column Mounted Car Riding Lantern: A car riding lantern shall be installed in the elevator cab and located in the entrance. The lantern, when illuminated, will indicate the intended direction of travel. The lantern will illuminate, and a signal will sound when the car arrives at a floor where it will stop. The lantern shall remain illuminated until the door(s) begin to close.
- E. Special Equipment: Not Applicable

## 2.09 CONTROL SYSTEMS

- A. Controller: The elevator control system shall be microprocessor based and software oriented. Control of the elevator shall be automatic in operation by means of push buttons in the car numbered to correspond to floors served, for registering car stops, and by "up-down" push buttons at each intermediate landing and "call" push buttons at terminal landings.
- B. Automatic Light and Fan shut down: The control system shall evaluate the system activity and automatically turn off the cab lighting and ventilation fan during periods of inactivity. The settings shall be field programmable.
- C. Emergency Power Operation: (Battery Lowering 10-DOC) When the loss of normal power is detected, a battery lowering feature is to be activated. The elevator will lower to a predetermined level and open the doors. After passengers have exited the car, the doors will close and the car will shutdown. When normal power becomes available, the elevator will automatically resume operation. The battery lowering feature is included in the elevator contract and does not utilize a building-supplied standby power source.
- D. Special Operation: Not Applicable

## 2.10 HALL STATIONS

- A. Hall Stations, General: Buttons shall illuminate to indicate call has been registered at that floor for the indicated direction.

1. Provide one pushbutton riser with faceplates having a No. 4 brushed stainless steel finish.
  - a. Phase 1 firefighter's service key switch, with instructions, shall be incorporated into the hall station at the designated level.
- B. Floor Identification Pads: Provide door jamb pads at each floor. Jamb pads shall comply with Americans with Disabilities Act (ADA) requirements.
- C. Hall Position Indicator: Not Applicable
- D. Hall lanterns: Not Applicable
- E. Special Equipment: Not Applicable

## 2.11 MISCELLANEOUS ELEVATOR COMPONENTS

- A. Oil Hydraulic Silencer: Install multiple oil hydraulic silencers (muffler device) at the power unit location. The silencers shall contain pulsation absorbing material inserted in a blowout proof housing.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Before starting elevator installation, inspect hoistway, hoistway openings, pits and/or control room, as constructed, verify all critical dimensions, and examine supporting structures and all other conditions under which elevator work is to be installed. Do not proceed with elevator installation until unsatisfactory conditions have been corrected in a manner acceptable to the installer.
- B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

### 3.02 INSTALLATION

- A. Install elevator systems components and coordinate installation of hoistway wall construction.
  1. Work shall be performed by competent elevator installation personnel in accordance with ASME A17.1, manufacturer's installation instructions and approved shop drawings.
  2. Comply with the National Electrical Code for electrical work required during installation.
- B. Jack unit excavation (if required by the type of jack provided): Drill or otherwise excavate below elevator pit construction as required to install the jack unit.

1. Install casing for jack unit.
  2. Provide HDPE jack protection system for all in ground jacks.
  3. Set casing for jack unit assembly plumb, and partially fill with water settled sand, eliminating voids. Back fill depth shall be sufficient to hold the bottom of the jack in place over time.
- C. Perform work with competent, skilled workmen under the direct control and supervision of the elevator manufacturer's experienced foreman.
- D. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports, and bracing including all setting templates and diagrams for placement.
- E. Welded construction: Provide welded connections for installation of 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 qualification of welding operators.
- F. Coordination: Coordinate elevator work with the work of other trades, for proper time and sequence to avoid construction delays. Use benchmarks, lines, and levels designated by the Contractor, to ensure dimensional coordination of the work.
- G. Install machinery, guides, controls, car and all equipment and accessories to provide a quiet, smoothly operating installation, free from side sway, oscillation or vibration.
- H. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with cars. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum safe, workable dimensions at each landing.
- I. Erect hoistway sills, headers, and frames before erection of rough walls and doors; erect fascia and toe guards after rough walls finished. Set sill units accurately aligned and slightly above finish floor at landings.
- J. Lubricate operating parts of system, where recommended by manufacturer.

### 3.03 FIELD QUALITY CONTROL

- A. Acceptance testing: Upon completion of the elevator installation and before permitting use of elevator, perform acceptance tests as required and recommended by Code and governing regulations or agencies. Perform other tests, if any, as required by governing regulations or agencies.

- B. Advise Owner, Contractor, Architect, and governing authorities in advance of dates and times tests are to be performed on the elevator.

### 3.04 ADJUSTING

- A. Make necessary adjustments of operating devices and equipment to ensure elevator operates smoothly and accurately.

### 3.05 CLEANING

- A. Before final acceptance, remove protection from finished surfaces and clean and polish surfaces in accordance with manufacturer's recommendations for type of material and finish provided. Stainless steel shall be cleaned with soap and water and dried with a non-abrasive surface; it shall not be cleaned with bleach-based cleansers.
- B. At completion of elevator work, remove tools, equipment, and surplus materials from site. Clean equipment rooms and hoistway. Remove trash and debris.
  - 1. Use environmentally preferable and low VOC emitting cleaners for each application type. Cleaners that contain solvents, pine and/or citrus oils are not permitted.

### 3.06 PROTECTION

- A. At time of Substantial Completion of elevator work, or portion thereof, provide suitable protective coverings, barriers, devices, signs, or other such methods or procedures to protect elevator work from damage or deterioration. Maintain protective measures throughout remainder of construction period.

### 3.07 DEMONSTRATION

- A. Instruct Owner's personnel in proper use, operations, and daily maintenance of elevators. Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies. Train Owner's personnel in normal procedures to be followed in checking for sources of operational failures or malfunctions.
- B. Make a final check of each elevator operation, with Owner's personnel present, immediately before date of substantial completion. Determine that control systems and operating devices are functioning properly.

### 3.08 ELEVATOR SCHEDULE

#### A. Elevator 1 –

1. Elevator Model: endura Above-Ground (2-Stage)
2. Elevator Type: Hydraulic Passenger
3. Rated Capacity: 3500 lbs.
4. Rated Speed: 150 ft./min.
5. Operation System: ICON32
6. Travel: 15'0"
7. Landings: 2 total
8. Openings:
  - a. Front: 2
  - b. Rear: 0
9. Clear Car Inside: 6' - 8" wide x 5' - 5" deep
10. Cab Height: 9'-0" standard
11. Hoistway Entrance Size: 3' - 6" wide x 8'-0" high
12. Door Type: Single Speed
13. Power Characteristics: 208 volts, 3 Phase, 60 Hz.
14. Seismic Requirements: Zone 1
15. Hoistway Dimensions: 8' - 8" wide x 6' - 11" deep
16. Pit Depth: 4' - 0"
17. Overhead: 13'2.5"
18. Button & Fixture Style: Traditional Signal Fixtures
19. Special Operations: None

### 3.09 SPECIAL CONDITIONS (Note: Add Special Conditions as Needed)

END OF SECTION

## SECTION 210500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Pipe, fittings, sleeves, escutcheons, seals, and connections for sprinkler systems.

## 1.2 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.
- B. Section 099113 - Exterior Painting: Preparation and painting of exterior fire protection piping systems.

## 1.3 REFERENCE STANDARDS

- A. ASME A112.18.1 - Plumbing Supply Fittings 2018.
- B. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing and Fusing Operators 2019.
- C. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250 2015.
- D. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2016.
- E. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250 2016.
- F. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2018).
- G. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service 2015a.
- H. ASTM A536 - Standard Specification for Ductile Iron Castings 1984 (Reapproved 2014).
- I. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type) 2016.
- J. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).
- K. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40 2017.
- L. ASTM F439 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80 2013.
- M. ASTM F442/F442M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR) 2013, with Editorial Revision.
- N. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings 2014.
- O. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings 2012.
- P. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings 2017.
- Q. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast 2017, with Errata (2018).
- R. AWWA C606 - Grooved and Shouldered Joints 2015.
- S. FM (AG) - FM Approval Guide current edition.
- T. ITS (DIR) - Directory of Listed Products current edition.
- U. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- V. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems 2016.
- W. UL (DIR) - Online Certifications Directory Current Edition.

#### 1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturers catalogue information. Indicate valve data and ratings.
- C. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.
- D. Project Record Documents: Record actual locations of components and tag numbering.
- E. Operation and Maintenance Data: Include installation instructions and spare parts lists.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.

#### 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified this section.
  - 1. Minimum three years experience.
  - 2. Approved by manufacturer.
- C. Comply with FM (AG) and UL (DIR) requirements.
- D. Valves: Bear FM (AG), UL (DIR), ITS (DIR) or Warnock Hersey and [ ] product listing label or marking. Provide manufacturer's name and pressure rating marked on valve body.
- E. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.
- F. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves in shipping containers, with labeling in place.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

#### 1.7 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.

### PART 2 PRODUCTS

#### 2.1 FIRE PROTECTION SYSTEMS

- A. Sprinkler Systems: Comply with NFPA 13.
- B. Standpipe and Hose Systems: Comply with NFPA 14.
- C. Welding Materials and Procedures: Comply with ASME BPVC-IX.

#### 2.2 ABOVE GROUND PIPING

- A. Steel Pipe: ASTM A53 Schedule 40 or ASTM A135/A135M Schedule 10, black.
  - 1. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings and ASME B16.4, threaded fittings.
  - 2. Malleable Iron Fittings: ASME B16.3, threaded fittings and ASTM A47/A47M.

3. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
  4. Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocket and O-ring, uniformly compressed into permanent mechanical engagement onto pipe.
- B. CPVC Pipe: ASTM F442/F442M, SDR 13.5.
1. Fittings: ASTM F438 Schedule 40, or ASTM F439 schedule 80, CPVC.
  2. Joints: Solvent welded, using ASTM F493 cement.
- C. Ductile Iron Pipe: AWWA C151/A21.51.
1. Fittings: AWWA C110/A21.10, standard thickness.
  2. Joints: AWWA C111/A21.11, SBR or vulcanized styrene butadiene rubber gasket.
- ## 2.3 PIPE SLEEVES
- A. Vertical Piping:
1. Sleeve Length: 1 inch ( 25 mm ) above finished floor.
  2. Provide sealant for watertight joint.
  3. Blocked Out Floor Openings: Provide 1-1/2 inch ( 40 mm ) angle set in silicon adhesive around opening.
  4. Drilled Penetrations: Provide 1-1/2 inch ( 40 mm ) angle ring or square set in silicone adhesive around penetration.
- B. Plastic, Sheet Metal, or Moisture-Resistant Fiber: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.
- C. Pipe Passing Through Below Grade Exterior Walls:
1. Zinc coated or cast iron pipe.
  2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.
- D. Pipe Passing Through Concrete Beam Flanges, except where Brass Pipe Sleeves are Specified:
1. Galvanized steel pipe or black iron pipe with asphalt coating.
  2. Connect sleeve with floor plate except in mechanical rooms.
- E. Pipe Passing Through Mechanical, Laundry, and Animal Room Floors above Basement:
1. Galvanized steel pipe or black iron pipe with asphalt coating.
  2. Connect sleeve with floor plate except in mechanical rooms.
- F. Not required for wall hydrants for fire department connections or in drywall construction.
- G. Penetrations in concrete beam flanges are permitted but are prohibited through ribs or beams without prior approval from the Architect.
- H. Clearances:
1. Provide allowance for insulated piping.
  2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch ( 25 mm ) greater than external; pipe diameter.
  3. Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.
- ## 2.4 FIRE-RATED ENCLOSURES
- A. Provide as required to preserve fire resistance rating of building elements.



## 2.5 ESCUTCHEONS

### A. Manufacturers:

1. Fire Protection Products, Inc; [ ]: [www.fppi.com/#sle.com/#sle](http://www.fppi.com/#sle.com/#sle).
2. Tyco Fire Protection Products; [ ]: [www.tyco-fire.com/#sle](http://www.tyco-fire.com/#sle).
3. Viking Group Inc; [ ]: [www.vikinggroupinc.com/#sle](http://www.vikinggroupinc.com/#sle).
4. Substitutions: See Section 016000 - Product Requirements.

### B. Material:

1. Grade TP304, seamless tube, ASTM A269/A269M stainless steel.
2. Metals and Finish: Comply with ASME A112.18.1.

### C. Construction:

1. One-piece for mounting on chrome-plated tubing, pipe or [ ] and one-piece or split-pattern type elsewhere.
2. Internal spring tension devices or setscrews to maintain a fixed position against a surface.

## 2.6 PIPE HANGERS AND SUPPORTS

- A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch ( 15 to 40 mm ): Malleable iron, adjustable swivel, split ring.
- B. Hangers for Pipe Sizes 2 inches ( 50 mm ) and Over: Carbon steel, adjustable, clevis.
- C. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- D. Wall Support for Pipe Sizes to 3 inches ( 80 mm ): Cast iron hook.
- E. Wall Support for Pipe Sizes 4 inches ( 100 mm ) and Over: Welded steel bracket and wrought steel clamp.
- F. Vertical Support: Steel riser clamp.
- G. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

## 2.7 MECHANICAL COUPLINGS

### A. Manufacturers:

1. Tyco Fire Protection Products; Grinnell G-Fire Figure 705 Grooved Flexible Couplings: [www.tyco-fire.com/#sle](http://www.tyco-fire.com/#sle).
2. Victaulic Company; FireLock Style 009H: [www.victaulic.com/#sle](http://www.victaulic.com/#sle).
3. Substitutions: See Section 016000 - Product Requirements.

### B. Rigid Mechanical Couplings for Grooved Joints:

1. Dimensions and Testing: Comply with AWWA C606.
2. Minimum Working Pressure: 300 psig ( 2065 kPa ).
3. Housing Material: Fabricate of ductile iron complying with ASTM A536.
4. Housing Coating: Factory applied orange enamel or [ ].
5. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F ( minus 34 degrees C ) to 230 degrees F ( 110 degrees C ).
6. Bolts and Nuts: Hot dipped galvanized or zinc electroplated steel.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and foreign material, from inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

### 3.2 INSTALLATION

- A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.

- B. Install standpipe piping, hangers, and supports in accordance with NFPA 14.
- C. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- D. Install piping to conserve building space, to not interfere with use of space and other work.
- E. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- G. Inserts:
  - 1. Provide inserts for placement in concrete formwork.
  - 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
  - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches ( 100 mm ).
  - 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
  - 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
- H. Pipe Hangers and Supports:
  - 1. Install hangers to provide minimum 1/2 inch ( 15 mm ) space between finished covering and adjacent work.
  - 2. Place hangers within 12 inches ( 300 mm ) of each horizontal elbow.
  - 3. Use hangers with 1-1/2 inch ( 40 mm ) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
  - 4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
  - 5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
  - 6. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
    - a. Painting of exterior fire suppression systems is specified in Section 099113.
- I. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
- J. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- K. Provide sleeves when penetrating footings, floors, walls, partitions and [\_\_\_\_]. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.
  - 1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.
  - 2. Aboveground Piping:
    - a. Pack solid using mineral fiber complying with ASTM C592.
    - b. Fill space with an elastomer caulk to a depth of 0.50 inch ( 15 mm ) where penetrations occur between conditioned and unconditioned spaces.

3. All Rated Openings: Caulk tight with fire stopping material complying with ASTM E814 in accordance with Section 078400 to prevent the spread of fire, smoke, and gases.
  4. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.
- L. Escutcheons:
1. Install and firmly attach escutcheons at piping penetrations into finished spaces.
  2. Provide escutcheons on both sides of partitions separating finished areas through which piping passes.
  3. Use chrome plated escutcheons in occupied spaces and to conceal openings in construction.
- M. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

END OF SECTION

## SECTION 210523 - GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Two-piece ball valves with indicators.
- B. Bronze butterfly valves with indicators.
- C. Iron butterfly valves with indicators.
- D. Check valves.
- E. Bronze OS&Y gate valves.
- F. Iron OS&Y gate valves.
- G. NRS gate valves.
- H. Indicator posts.
- I. Trim and drain valves.

#### 1.2 RELATED REQUIREMENTS

- A. Section 210553 - Identification for Fire Suppression Piping and Equipment.
- B. Section 211200 - Fire-Suppression Standpipes.
- C. Section 211300 - Fire-Suppression Sprinkler Systems.

#### 1.3 ABBREVIATIONS AND ACRONYMS

- A. EPDM: Ethylene-propylene diene monomer.
- B. NRS: Non-rising stem.
- C. OS&Y: Outside screw and yoke.
- D. PTFE: Polytetrafluoroethylene.

#### 1.4 REFERENCE STANDARDS

- A. ASME B1.20.1 - Pipe Threads, General Purpose (Inch) 2013 (Reaffirmed 2018).
- B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250 2015.
- C. ASME B31.9 - Building Services Piping 2017.
- D. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing and Fusing Operators 2019.
- E. AWWA C606 - Grooved and Shouldered Joints 2015.
- F. FM (AG) - FM Approval Guide current edition.
- G. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. NFPA 13R - Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies 2019.
- I. UL (DIR) - Online Certifications Directory Current Edition.
- J. UL 262 - Gate Valves for Fire-Protection Service Current Edition, Including All Revisions.
- K. UL 312 - Check Valves for Fire-Protection Service Current Edition, Including All Revisions.
- L. UL 789 - Indicator Posts for Fire-Protection Service Current Edition, Including All Revisions.
- M. UL 1091 - Standard for Butterfly Valves for Fire-Protection Service Current Edition, Including All Revisions.

#### 1.5 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

## 1.6 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

## 1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
  - 1. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Where listed products are specified, provide products listed, classified, and labeled by FM (AG), UL (DIR) or testing firm acceptable to authorities having jurisdiction as suitable for the purpose indicated.
- C. Welding Materials and Procedures: Comply with ASME BPVC-IX.
- D. Installer and Maintenance Contractor Qualifications:
  - 1. Company specializing in performing the work of this section with minimum five years documented experience.
  - 2. Trained and approved by manufacturer to design, install, test and maintain the equipment specified herein.
  - 3. Complies with manufacturer's certification requirements.
  - 4. Complies with manufacturer's insurance requirements.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, and weld ends.
  - 3. Set valves open to minimize exposure of functional surfaces.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection and protect flanges and specialties from dirt.
    - a. Provide temporary inlet and outlet caps.
    - b. Maintain caps in place until installation.
  - 2. Store valves in shipping containers and maintain in place until installation.
    - a. Store valves indoors and maintain at higher than ambient dew point temperature.
    - b. If outdoor storage is unavoidable, store valves off the ground in watertight enclosures.
- C. Use the following precautions for handling:
  - 1. Use sling to handle large valves, rigged to avoid damage to exposed parts.
  - 2. Do not use operating handles or stems as lifting or rigging points.

## PART 2 PRODUCTS

### 2.1 GENERAL REQUIREMENTS

- A. UL Listed: Provide valves listed in UL (DIR) under following headings and bearing UL mark:
  - 1. Main Level: HAMV - Fire Main Equipment.
    - a. Level 1: HCBZ - Indicator Posts, Gate Valve.
    - b. Level 1: HLOT - Valves.
    - c. Level 3: HLUG - Ball Valves, System Control.

- d. Level 3: HLXS - Butterfly Valves.
      - e. Level 3: HMER - Check Valves.
      - f. Level 3: HMRZ - Gate Valves.
    - 2. Main Level: VDGT - Sprinkler System & Water Spray System Devices.
      - a. Level 1: VQGU - Valves, Trim, and Drain.
  - B. FM Global Approved: Provide valves listed in FM (AG) Approval Guide under the following headings:
    - 1. Automated Sprinkler Systems:
      - a. Indicator posts.
      - b. Valves:
        - 1) Gate valves.
        - 2) Single check valves.
        - 3) Miscellaneous valves.
  - C. ASME Compliance:
    - 1. ASME B16.1 for flanges on iron valves.
    - 2. ASME B1.20.1 for threads on threaded-end valves.
    - 3. ASME B31.9 for building services piping valves.
  - D. Comply with AWWA C606 for grooved-end connections.
  - E. Comply with NFPA 13, NFPA 13R and [ ] for valves.
  - F. Valve Pressure Ratings: Not less than minimum pressure rating indicated or higher as required.
  - G. Valve Sizes: Same as upstream piping unless otherwise indicated.
  - H. Valve Actuator Types:
    - 1. Worm-gear actuator with handwheel for quarter-turn valves, except trim and drain valves.
    - 2. Handwheel: For other than quarter-turn trim and drain valves.
    - 3. Hand-lever: For quarter-turn trim and drain valves 2 NPS ( 50 DN ) and smaller.
- 2.2 TWO-PIECE BALL VALVES WITH INDICATORS
- A. UL 1091, except with ball instead of disc and FM (AG) standard listing for indicating valves (butterfly or ball type), Class Number 1112.
  - B. Description:
    - 1. Minimum Pressure Rating: 175 psig ( 1200 kPa ).
    - 2. Body Design: Two piece.
    - 3. Body Material: Forged brass or bronze.
    - 4. Port Size: Full or standard.
    - 5. Seat: PTFE.
    - 6. Stem: Bronze or stainless steel.
    - 7. Ball: Chrome-plated brass.
    - 8. Actuator: Worm gear or traveling nut.
    - 9. Supervisory Switch: Internal or external.
    - 10. End Connections for Valves 1 NPS ( 25 DN ) through 2 NPS ( 50 DN ): Threaded ends.
    - 11. End Connections for Valves 2-1/2 NPS ( 65 DN ): Grooved ends.
- 2.3 BRONZE BUTTERFLY VALVES WITH INDICATORS
- A. UL 1091 and FM (AG) standard listing for indicating valves, (butterfly or ball type), Class Number 1112.
  - B. Minimum Pressure Rating: 175 psig ( 1200 kPa ).
  - C. Body Material: Bronze.

- D. Seat: EPDM.
  - E. Stem: Bronze or stainless steel.
  - F. Disc: Bronze with EPDM coating.
  - G. Actuator: Worm gear or traveling nut.
  - H. Supervisory Switch: Internal or external.
  - I. End Connections for Valves 1 NPS ( 25 DN ) through 2 NPS ( 50 DN ): Threaded ends.
  - J. End Connections for Valves 2-1/2 NPS ( 65 DN ): Grooved ends.
- 2.4 IRON BUTTERFLY VALVES WITH INDICATORS
- A. UL 1091 and FM (AG) standard listing for indicating valves (butterfly or ball type), Class Number 112.
  - B. Minimum Pressure Rating: 175 psig ( 1200 kPa ).
  - C. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, polyamide or [ ] coating.
  - D. Seat: EPDM.
  - E. Stem: Stainless steel.
  - F. Disc: Ductile iron, nickel plated.
  - G. Actuator: Worm gear or traveling nut.
  - H. Supervisory Switch: Internal or external.
  - I. Body Design: Grooved-end connections.
- 2.5 CHECK VALVES
- A. UL 312 and FM (AG) standard listing for check valves, Class Number 1045.
  - B. Minimum Pressure Rating: 175 psig ( 1200 kPa ).
  - C. Type: Center guided check valve.
  - D. Body Material: Cast iron, ductile iron.
  - E. Center guided check with elastomeric seal.
  - F. Hinge Spring: Stainless steel.
  - G. End Connections: Flanged, grooved, or threaded.
- 2.6 BRONZE OS&Y GATE VALVES
- A. UL 262 and FM (AG) standard listing for fire-service water control valves (OS&Y and NRS-type gate valves).
  - B. Minimum Pressure Rating: 175 psig ( 1200 kPa ).
  - C. Body and Bonnet Material: Bronze or brass.
  - D. Wedge: One-piece bronze or brass.
  - E. Wedge Seat: Bronze.
  - F. Stem: Bronze or brass.
  - G. Packing: Non-asbestos PTFE.
  - H. Supervisory Switch: External.
  - I. End Connections: Threaded.
- 2.7 IRON OS&Y GATE VALVES
- A. UL 262 and FM (AG) standard listing for fire-service water control valves (OS&Y and NRS-type gate valves).
  - B. Minimum Pressure Rating: 175 psig ( 1200 kPa ).
  - C. Body and Bonnet Material: Cast or ductile iron.
  - D. Wedge: Cast or ductile iron, or bronze with elastomeric coating.
  - E. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
  - F. Stem: Brass or bronze.
  - G. Packing: Non-asbestos PTFE.
  - H. Supervisory Switch: External.

- I. End Connections: Flanged.

## 2.8 NRS GATE VALVES

- A. UL 262 and FM (AG) standard listing for fire-service water control valves (OS&Y and NRS-type gate valves).
- B. Minimum Pressure Rating: 175 psig ( 1200 kPa ).
- C. Body and Bonnet Material: Cast or ductile iron.
- D. Wedge: Cast or ductile iron with elastomeric coating.
- E. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
- F. Stem: Brass or bronze.
- G. Packing: Non-asbestos PTFE.
- H. Supervisory Switch: External.
- I. End Connections: Flanged.

## 2.9 INDICATOR POSTS

- A. UL 789 and FM (AG) standard listing for indicator posts.
- B. Type: Underground.
- C. Base Barrel Material: Cast or ductile iron.
- D. Extension Barrel for Adjustable Length Indicator Posts: Cast or ductile iron.
- E. Cap: Cast or ductile iron.
- F. Operation: Wrench.

## 2.10 TRIM AND DRAIN VALVES

- A. Ball Valves:
  - 1. Description:
    - a. Pressure Rating: 175 psig ( 1200 kPa ).
    - b. Body Design: Two piece.
    - c. Body Material: Forged brass or bronze.
    - d. Port Size: Full or standard.
    - e. Seat: PTFE.
    - f. Stem: Bronze or stainless steel.
    - g. Ball: Chrome-plated brass.
    - h. Actuator: Hand-lever.
    - i. End Connections for Valves 1 NPS ( 25 DN ) through 2-1/2 NPS ( 65 DN ): Threaded ends.
    - j. End Connections for Valves 1-1/4 NPS ( 32 DN ) and 2-1/2 NPS ( 65 DN ): Grooved ends.
- B. Angle Valves:
  - 1. Description:
    - a. Pressure Rating: 175 psig ( 1200 kPa ).
    - b. Body Material: Brass or bronze.
    - c. Ends: Threaded.
    - d. Stem: Bronze.
    - e. Disc: Bronze.
    - f. Packing: Asbestos free.
    - g. Handwheel: Malleable iron, bronze, or aluminum.
- C. Globe Valves:
  - 1. Description:
    - a. Pressure Rating: 175 psig ( 1200 kPa ).
    - b. Body Material: Bronze with integral seat and screw-in bonnet.
    - c. Ends: Threaded.
    - d. Stem: Bronze.



- e. Disc Holder and Nut: Bronze.
- f. Disc Seat: Nitrile.
- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron, bronze, or aluminum.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Confirm valve interior to be free of foreign matter and corrosion.
- B. Remove packing materials.
- C. Examine guides and seats by operating valves from the fully open position to the fully closed position.
- D. Examine valve threads and mating pipe for form and cleanliness.
- E. Examine mating flange faces for conditions that might cause leakage.
  - 1. Check bolting for proper size, length, and material.
  - 2. Verify gasket for size, defects, damage, and suitable material composition for service.
  - 3. Replace all defective valves with new valves.

#### 3.2 INSTALLATION

- A. Comply with specific valve installation requirements and application in the following Sections:
  - 1. Section 211200 for application of valves in fire-suppression standpipes.
  - 2. Section 211300 for application of valves in wet and dry pipe, fire-suppression sprinkler systems.
- B. Install listed fire protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections.
  - 1. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in water supply connections and backflow preventer at potable water supply connections.
- D. Valves with threaded connections to have unions at equipment arranged for easy access, service, maintenance, and equipment removal without system shutdown.
- E. Valves in horizontal piping installed with stem at or above the pipe center.
- F. Position valves to allow full stem movement.
- G. Install valve tags. Comply with Section 210553 requirements for valve tags, schedules, and signs on surfaces concealing valves; and the appropriate NFPA standard applying to the piping system in which valves are installed.

END OF SECTION

## SECTION 210553 - IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Stencils.
- D. Pipe markers.

#### 1.2 RELATED REQUIREMENTS

- A. Section 099123 - Interior Painting: Stencil paint.

#### 1.3 REFERENCE STANDARDS

- A. ASTM D709 - Standard Specification for Laminated Thermosetting Materials 2017.

#### 1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Product Data: Provide manufacturers catalog literature for each product required.
- E. Manufacturer's Installation Instructions: Indicate special procedures, and installation instructions.
- F. Project Record Documents: Record actual locations of tagged valves.

### PART 2 PRODUCTS

#### 2.1 IDENTIFICATION APPLICATIONS

- A. Automatic Controls: Tags.
- B. Control Panels: Nameplates.
- C. Instrumentation: Tags.
- D. Major Control Components: Nameplates.
- E. Piping: Tags.
- F. Pumps: Nameplates.
- G. Relays: Tags.
- H. Small-sized Equipment: Tags.
- I. Thermostats: Nameplates.
- J. Valves: Nameplates.

#### 2.2 NAMEPLATES

- A. Manufacturers:
  - 1. Brimar Industries, Inc; [ ]: [www.pipemarker.com/#sle](http://www.pipemarker.com/#sle).
  - 2. Kolbi Pipe Marker Company; [ ]: [www.kolbipipemarkers.com/#sle](http://www.kolbipipemarkers.com/#sle).
  - 3. Seton Identification Products, a Tricor Direct Company; [ ]: [www.seton.com/#sle](http://www.seton.com/#sle).
  - 4. Substitutions: See Section 016000 - Product Requirements.
- B. Description: Laminated three-layer plastic with engraved letters.
  - 1. Letter Color: White.
  - 2. Letter Height: 1/4 inch ( 6 mm ).
  - 3. Background Color: Black.
  - 4. Thickness: 1/8 inch ( 3 mm ).
  - 5. Plastic: Comply with ASTM D709.

#### 2.3 TAGS

- A. Manufacturers:

1. Advanced Graphic Engraving, LLC; [ ]:  
www.advancedgraphicengraving.com/#sle.
  2. Brady Corporation; [ ]: www.bradycorp.com/#sle.
  3. Brimar Industries, Inc; [ ]: www.pipemarker.com/#sle.
  4. Kolbi Pipe Marker Company; [ ]: www.kolbipipemarkers.com/#sle.
  5. Seton Identification Products, a Tricor Direct Company; [ ]:  
www.seton.com/#sle.
  6. Substitutions: See Section 016000 - Product Requirements.
- B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch ( 40 mm ) diameter with smooth edges.
- C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.
- ## 2.4 STENCILS
- A. Manufacturers:
1. Brady Corporation; [ ]: www.bradycorp.com/#sle.
  2. Kolbi Pipe Marker Company; [ ]: www.kolbipipemarkers.com/#sle.
  3. Seton Identification Products, a Tricor Direct Company; [ ]:  
www.seton.com/#sle.
  4. Substitutions: See Section 016000 - Product Requirements.
- B. Stencils: With clean cut symbols and letters of following size:
1. 3/4 to 1-1/4 inch ( 20-30 mm ) Outside Diameter of Insulation or Pipe: 8 inch ( 200 mm ) long color field, 1/2 inch ( 15 mm ) high letters.
  2. 1-1/2 to 2 inch ( 40-50 mm ) Outside Diameter of Insulation or Pipe: 8 inch ( 200 mm ) long color field, 3/4 inch ( 20 mm ) high letters.
  3. 2-1/2 to 6 inch ( 65-150 mm ) Outside Diameter of Insulation or Pipe: 12 inch ( 300 mm ) long color field, 1-1/4 inch ( 30 mm ) high letters.
  4. 8 to 10 inch ( 200-250 mm ) Outside Diameter of Insulation or Pipe: 24 inch ( 600 mm ) long color field, 2-1/2 inch ( 65 mm ) high letters.
  5. Equipment: 2-1/2 inch ( 65 mm ) high letters.
- C. Paint for Stencils: As specified in Section 099123, semi-gloss enamel, colors complying with ASME A13.1.
- ## 2.5 PIPE MARKERS
- A. Manufacturers:
1. Brady Corporation; [ ]: www.bradycorp.com/#sle.
  2. Brimar Industries, Inc; [ ]: www.pipemarker.com/#sle.
  3. Kolbi Pipe Marker Company; [ ]: www.kolbipipemarkers.com/#sle.
  4. MIFAB, Inc; [ ]: www.mifab.com/#sle.
  5. Seton Identification Products, a Tricor Company; [ ]:  
www.seton.com/#sle.
  6. Substitutions: See Section 016000 - Product Requirements.
- B. Color: Comply with ASME A13.1.
- C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- E. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches ( 150 mm ) wide by 4 mil ( 0.10 mm ) thick, manufactured for direct burial service.
- F. Color code as follows:

1. Fire Quenching Fluids: Red with white letters.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Section 099123 for stencil painting.

### 3.2 INSTALLATION

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive.  
Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Apply stencil painting in accordance with Section 099123.
- D. Install plastic pipe markers in accordance with manufacturer's instructions.
- E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- F. Install underground plastic pipe markers 6 to 8 inches ( 150 to 200 mm ) below finished grade, directly above buried pipe.

END OF SECTION

## SECTION 211200 - FIRE-SUPPRESSION STANDPIPES

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Valves.
- B. Fire department connections.

## 1.2 RELATED REQUIREMENTS

- A. Section 013000 - Administrative Requirements: Submittal procedures, project meetings, progress schedules and documentation, reports, coordination.
- B. Section 016000 - Product Requirements: Fundamental product requirements, substitutions and product options, delivery, storage, and handling.
- C. Section 210500 - Common Work Results for Fire Suppression: Fire protection piping.
- D. Section 210523 - General-Duty Valves for Water-Based Fire-Suppression Piping.
- E. Section 210553 - Identification for Fire Suppression Piping and Equipment.
- F. Section 211300 - Fire-Suppression Sprinkler Systems.
- G. Section 213000 - Fire Pumps.

## 1.3 REFERENCE STANDARDS

- A. FM (AG) - FM Approval Guide current edition.
- B. ITS (DIR) - Directory of Listed Products current edition.
- C. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems 2016.
- D. NFPA 1963 - Standard for Fire Hose Connections 2019.
- E. UL 405 - Fire Department Connection Devices Current Edition; Including All Revisions.
- F. UL (DIR) - Online Certifications Directory Current Edition.

## 1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's catalog sheet for equipment indicating rough-in size, finish, and accessories.
- C. Shop Drawings: Indicate supports, components, accessories, and sizes.
  - 1. Submit shop drawings and product data to Owner's insurance underwriter for approval.
  - 2. Submit proof of approval to Architect.
- D. Project Record Documents: Record actual locations of components.
- E. Operation Data: Include appropriate manufacturer's data.
- F. Maintenance Data: Include servicing requirements and test schedule.
- G. Certificates: Provide certificate of compliance from authority having jurisdiction indicating approval of field acceptance tests.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2.

## 1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with NFPA 14. Maintain one copy on site.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years documented experience and approved by manufacturer.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in shipping packaging until installation.

## PART 2 PRODUCTS

### 2.1 VALVES

- A. General Duty Valves: Refer to Section 210523.
- B. Specialty Valves:
  - 1. Hose Connection Valve:
    - a. Angle type; brass finish; 2-1/2 NPS ( 65 DN ), thread to match fire department hardware, 300 psi ( 2070 kPa ) working pressure, with threaded cap and chain of same material and finish.
  - 2. Pressure Reducing Valve:
    - a. Angle type; brass finish with inner hydraulic controls; 1-1/2 inch ( 40 mm ) size, thread to match fire department hardware, 400 psi ( 2760 kPa ) inlet pressure, with threaded cap and chain of same material and finish.

### 2.2 FIRE DEPARTMENT CONNECTIONS

- A. Type: Flush, wall mount made of corrosion resistant metal complying with UL 405.
  - 1. Manufacturers:
    - a. Elkhart Brass Manufacturing Company, Inc; [ ]: [www.elkhartbrass.com/#sle](http://www.elkhartbrass.com/#sle).
    - b. Fire End & Croker Corporation; [ ]: [www.croker.com/#sle](http://www.croker.com/#sle).
    - c. Substitutions: See Section 016000 - Product Requirements.
  - 2. Inlets: Two way, 2-1/2 inch ( 65 DN ) swivel fittings, internal threaded. Thread size and inlets according to NFPA 1963 or Authority Having Jurisdiction. Brass caps with gaskets, chains, and lugs.
  - 3. Configuration: Horizontal.
  - 4. Outlet: With pipe threads, 6 NPS ( 150 DN ).
    - a. Location: Back.
  - 5. Rated Working Pressure: 175 psi ( 1200 kPa ).
  - 6. Finish: Chrome.
  - 7. Signage: Raised or engraved lettering 1 inch ( 25.4 mm ) minimum indicating system type.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NFPA 14.
- C. Connect standpipe system to water source ahead of domestic water connection.
- D. Where static pressure exceeds 100 psi ( 690 kPa ) but is less than 100 psi ( 690 kPa ) at any hose station, provide pressure orifice disc in discharge of hose station valve to prevent pressure on hose exceeding 90 psi ( 620 kPa ).
- E. Where static pressure exceeds 100 psi ( 690 kPa ) at any hose station, provide pressure reducing valve to prevent pressure on hose exceeding 90 psi ( 620 kPa ).
- F. Provide two way fire department outlet connection on roof.
- G. Flush entire system of foreign matter.

END OF SECTION

## SECTION 211300 - FIRE-SUPPRESSION SPRINKLER SYSTEMS

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Wet-pipe sprinkler system.
- B. System design, installation, and certification.
- C. Fire department connections.

## 1.2 RELATED REQUIREMENTS

- A. Section 210500 - Common Work Results for Fire Suppression: Pipe and fittings.
- B. Section 210523 - General-Duty Valves for Water-Based Fire-Suppression Piping.
- C. Section 210553 - Identification for Fire Suppression Piping and Equipment.
- D. Section 211200 - Fire-Suppression Standpipes.
- E. Section 213000 - Fire Pumps.
- F. Section 220548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.
- G. Section 220553 - Identification for Plumbing Piping and Equipment.

## 1.3 REFERENCE STANDARDS

- A. FM (AG) - FM Approval Guide current edition.
- B. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements 2015.
- C. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements 2016.
- D. UL (DIR) - Online Certifications Directory Current Edition.
- E. UL 405 - Fire Department Connection Devices Current Edition; Including All Revisions.

## 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.

## 1.5 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Shop Drawings:
  - 1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
  - 2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls.
  - 3. Submit shop drawings to Authorities Having Jurisdiction for approval. Submit proof of approval to Architect.
- D. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.
- E. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Sprinklers: Type and size matching those installed, in quantity required by referenced NFPA design and installation standard.
  - 3. Sprinkler Wrenches: For each sprinkler type.

- G. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

#### 1.6 QUALITY ASSURANCE

- A. Maintain one copy of referenced design and installation standard on site.
- B. Comply with FM (AG) requirements.
- C. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
- D. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- E. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years experience and approved by manufacturer.
- F. Equipment and Components: Provide products that bear FM (AG) label or marking.
- G. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Sprinklers, Valves, and Equipment:
  - 1. Tyco Fire Protection Products; [ ]: [www.tyco-fire.com/#sle](http://www.tyco-fire.com/#sle).
  - 2. Viking Corporation; [ ]: [www.vikinggroupinc.com/#sle](http://www.vikinggroupinc.com/#sle).
  - 3. Or approved equal..
  - 4. Substitutions: See Section 016000 - Product Requirements.

#### 2.2 SPRINKLER SYSTEM

- A. Sprinkler System: Provide coverage for entire building.
- B. Occupancy: For Residential areas - residential fire sprinkler requirements found in NFPA 13; For Office areas - Light Hazard; For Mercantile and Storage areas - Ordinary hazard, Group 2; comply with NFPA 13..
- C. Water Supply: Flow test conducted on 10/22/2018 resulted in 84 PSI static, 74 PSI residual at 600 GPM. Calculated flow of 1,635 GPM at 20 PSI.
  - 1. Revise design when test data available prior to submittals.
- D. Interface system with building control system.
- E. Provide fire department connections where indicated.
- F. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.
- G. Pipe Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
  - 1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
  - 2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
  - 3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
  - 4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
  - 5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.
  - 6. Other Types: As required.
  - 7. Manufacturers:
    - a. Powers Fasteners, Inc; [ ] [www.powers.com/#sle](http://www.powers.com/#sle).
    - b. Substitutions: See Section 016000 - Product Requirements.



## 2.3 SPRINKLERS

- A. Suspended Ceiling Type: Semi-recessed pendant type with matching push on escutcheon plate.
  - 1. Response Type: Quick.
  - 2. Coverage Type: Standard.
  - 3. Finish: Coordinate with Architect .
  - 4. Escutcheon Plate Finish: Coordinate with Architect.
  - 5. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
  - 6. Manufacturers:
    - a. Tyco Fire Protection Products; RAVEN Studio Sprinklers: [www.tyco-fire.com/#sle](http://www.tyco-fire.com/#sle).
    - b. Substitutions: See Section 016000 - Product Requirements.
- B. Exposed Area Type: Pendant type with guard.
  - 1. Response Type: Quick.
  - 2. Coverage Type: Standard.
  - 3. Finish: Brass.
  - 4. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
- C. Sidewall Type: Semi-recessed horizontal sidewall type with matching push on escutcheon plate.
  - 1. Response Type: Quick.
  - 2. Coverage Type: Standard.
  - 3. Finish: Coordinate with Architect .
  - 4. Escutcheon Plate Finish: Coordinate with Architect .
  - 5. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
- D. Residential Sprinklers: Concealed upright type with matching push on escutcheon plate.
  - 1. Response Type: Quick.
  - 2. Finish: Coordinate with Architect .
  - 3. Cover Plate Finish: Coordinate with Architect.
  - 4. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
- E. Storage Sprinklers: Pendant type with guard.
  - 1. Response Type: Standard.
  - 2. Coverage Type: Standard.
  - 3. Finish: Chrome plated.
  - 4. Fusible Link: Fusible solder link type temperature rated for specific area hazard.
- F. Guards: Finish to match sprinkler finish.
- G. Flexible Drop System: Stainless steel, multiple use, open gate type.
  - 1. Application: Use to properly locate sprinkler heads.
  - 2. Include all supports and bracing.
  - 3. Provide braided type tube as required for the application.
  - 4. Manufacturers:
    - a. Victaulic Company; Vic-Flex: [www.victaulic.com/#sle](http://www.victaulic.com/#sle).
    - b. Substitutions: See Section 016000 - Product Requirements.

## 2.4 PIPING SPECIALTIES

- A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm, pressure retard chamber and variable pressure trim with the following additional capabilities and features:
  - 1. Activate electric alarm.
  - 2. Test and drain valve.
  - 3. Replaceable internal components without removing valve from installed position.
  - 4. Manufacturers:
    - a. Victaulic Company; Series 751 with Series 760 motor alarm: [www.victaulic.com/#sle](http://www.victaulic.com/#sle).
    - b. Substitutions: See Section 016000 - Product Requirements.
- B. Backflow Preventer: Reduced pressure principle valve assembly backflow preventer with drain and OS & Y gate valve on each end.
- C. Test Connections:
  - 1. Inspector's Test Connection for Preaction Systems:
    - a. Provide test connections approximately 6 ft ( 2 m ) above floor for each or portion of each sprinkler system equipped with an alarm device, located at the most remote part of each system.
    - b. Route test connection to an open-site drain location, excluding janitor sinks, accepting full flow without negative consequences.
    - c. Supply discharge orifice with same size as corresponding sprinkler orifice.
    - d. Limit vertical height of exterior wall penetration to 2 ft ( 0.61 m ) above finished grade.
  - 2. Backflow Preventer Test Connection:
    - a. Provide downstream of the backflow prevention assembly, listed hose valves with 2.5 inch ( 65 mm ) National Standard male hose threads with cap and chain.
    - b. Furnish one valve for each 250 gpm ( 16 L/s ) of system demand or fraction thereof.
    - c. Provide permanent sign reading "Test Valve" in accordance with Section 220553.
- D. Water Motor Alarm: Hydraulically operated impeller type alarm with aluminum alloy chrome plated gong and motor housing, nylon bearings, and inlet strainer.
- E. Fire Department Connections:
  - 1. Type: Flush, wall mount made of corrosion resistant metal complying with UL 405.
    - a. Configuration: Horizontal.
    - b. Outlet: With pipe threads, 4 NPS ( 100 DN ).
      - 1) Location: Back.
    - c. Rated Working Pressure: 175 psi ( 1200 kPa ).
    - d. Finish: Chrome.
    - e. Signage: Raised or engraved lettering 1 inch ( 25.4 mm ) minimum indicating system type.

## 2.5 PRESSURE MAINTENANCE PUMP

- A. Type: Close coupled motor and positive displacement pump unit.
- B. Construction: Bronze with stainless steel shafts, carbon bearings.
- C. Motor: Open drip proof, permanently lubricated.
- D. Accessories: Include flexible hose connections.

E. Operation: Manual.

## 2.6 AIR COMPRESSOR

A. Manufacturers:

1. General Air Products.
2. Or approved equal.
3. Substitutions: See Section 016000 - Product Requirements.

B. Compressor: Single unit, electric motor driven, motor, motor starter, safety valves, check valves, air maintenance device incorporating electric pressure switch and unloader valve.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with referenced NFPA design and installation standard.
- B. Install equipment in accordance with manufacturer's instructions.
- C. Provide approved double check valve assembly at sprinkler system water source connection.
- D. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.
- E. Locate outside alarm gong on building wall as indicated.
- F. Place pipe runs to minimize obstruction to other work.
- G. Place piping in concealed spaces above finished ceilings.
- H. Center sprinklers in two directions in ceiling tile and provide piping offsets as required.
- I. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.
- J. Install and connect to fire pump system in accordance with Section 213000.
- K. Install air compressor on vibration isolators. Refer to Section 220548.
- L. Flush entire piping system of foreign matter.
- M. Install guards on sprinklers where indicated.
- N. Hydrostatically test entire system.
- O. Require test be witnessed by Fire Marshal.

### 3.2 INTERFACE WITH OTHER PRODUCTS

- A. Ensure required devices are installed and connected as required to fire alarm system.

### 3.3 SCHEDULES

- A. System Hazard Areas:
  1. Offices: Light Hazard.
  2. Warehouse: Ordinary Hazard, Group 2.
  3. Residential 4-sprinkler flows in accordance with NFPA 13.

END OF SECTION

## SECTION 220519 - METERS AND GAUGES FOR PLUMBING PIPING

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Pressure gauges and pressure gauge taps.
- B. Thermometers and thermometer wells.

## 1.2 REFERENCE STANDARDS

- A. ASME B40.100 - Pressure Gauges and Gauge Attachments 2013.
- B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers 2014.
- C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers 2014, with Editorial Revision (2017).
- D. UL 393 - Indicating Pressure Gauges for Fire-Protection Service Current Edition, Including All Revisions.

## 1.3 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.
- C. Project Record Documents: Record actual locations of components and instrumentation.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements. for additional provisions.

## 1.4 FIELD CONDITIONS

- A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

## PART 2 PRODUCTS

## 2.1 PRESSURE GAUGES

- A. Manufacturers:
  - 1. Dwyer Instruments, Inc; [ ]: [www.dwyer-inst.com/#sle](http://www.dwyer-inst.com/#sle).
  - 2. Moeller Instrument Company, Inc; [ ]: [www.moellerinstrument.com/#sle](http://www.moellerinstrument.com/#sle).
  - 3. Omega Engineering, Inc; [ ]: [www.omega.com/#sle](http://www.omega.com/#sle).
  - 4. Substitutions: See Section 016000 - Product Requirements.
- B. Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
  - 1. Case: Steel with brass bourdon tube.
  - 2. Size: 4-1/2 inch ( 115 mm ) diameter.
  - 3. Mid-Scale Accuracy: One percent.
  - 4. Scale: Psi and kPa.

## 2.2 PRESSURE GAUGE TAPPINGS

- A. Gauge Cock: Tee or lever handle, brass for maximum 150 psi ( 1034 kPa ).
- B. Needle Valve: Brass, 1/4 inch ( 6 mm ) NPT for minimum 150 psi ( 1034 kPa ).

## 2.3 STEM TYPE THERMOMETERS

- A. Manufacturers:
  - 1. Dwyer Instruments, Inc; [ ]: [www.dwyer-inst.com/#sle](http://www.dwyer-inst.com/#sle).
  - 2. Omega Engineering, Inc; [ ]: [www.omega.com/#sle](http://www.omega.com/#sle).
  - 3. Substitutions: See Section 016000 - Product Requirements.
- B. Thermometers - Fixed Mounting: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish.

1. Size: 9 inch ( 225 mm ) scale.
  2. Window: Clear Lexan.
  3. Accuracy: 2 percent, per ASTM E77.
  4. Calibration: Degrees F.
- C. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.
1. Size: 9 inch ( 225 mm ) scale.
  2. Window: Clear Lexan.
  3. Accuracy: 2 percent, per ASTM E77.
  4. Calibration: Degrees F.
- 2.4 DIAL THERMOMETERS
- A. Manufacturers:
1. Dwyer Instruments, Inc; [ ]: [www.dwyer-inst.com/#sle](http://www.dwyer-inst.com/#sle).
  2. Omega Engineering, Inc; [ ]: [www.omega.com/#sle](http://www.omega.com/#sle).
  3. Weksler Glass Thermometer Corp; [ ]: [www.wekslerglass.com/#sle](http://www.wekslerglass.com/#sle).
  4. Substitutions: See Section 016000 - Product Requirements.
- B. Thermometers - Fixed Mounting: Dial type bimetallic actuated; ASTM E1; stainless steel case, silicone fluid damping, white with black markings and black pointer, hermetically sealed lens, stainless steel stem.
1. Size: 5 inch ( 125 mm ) diameter dial.
  2. Lens: Clear glass.
  3. Accuracy: 1 percent.
  4. Calibration: Degrees F.
- C. Thermometers - Adjustable Angle: Dial type bimetallic actuated; ASTM E1; stainless steel case, adjustable angle with front recalibration, silicone fluid damping, white with black markings and black pointer, hermetically sealed lens, stainless steel stem.
1. Size: 5 inch ( 125 mm ) diameter dial.
  2. Accuracy: 1 percent.
  3. Calibration: Degrees F.
- 2.5 TEST PLUGS
- A. Test Plug: 1/4 inch ( 6 mm ) or 1/2 inch ( 13 mm ) brass fitting and cap for receiving 1/8 inch ( 3 mm ) outside diameter pressure or temperature probe with Viton core for temperatures up to 400 degrees F ( 204 degrees C ).

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch ( 60 mm ) for installation of thermometer sockets. Ensure sockets allow clearance from insulation.
- C. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- D. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- E. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

F. Locate test plugs adjacent thermometers and thermometer sockets.

END OF SECTION

## SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Applications.
- B. General requirements.
- C. Angle valves.
- D. Ball valves.
- E. Butterfly valves.
- F. Check valves.
- G. Gate valves.
- H. Globe valves.
- I. Chainwheels.

## 1.2 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.
- B. Section 220548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.
- C. Section 220553 - Identification for Plumbing Piping and Equipment.
- D. Section 220719 - Plumbing Piping Insulation.
- E. Section 221005 - Plumbing Piping.

## 1.3 ABBREVIATIONS AND ACRONYMS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Non-rising stem.
- E. OS&Y: Outside screw and yoke.
- F. PTFE: Polytetrafluoroethylene.
- G. RS: Rising stem.
- H. SWP: Steam working pressure.
- I. TFE: Tetrafluoroethylene.

## 1.4 REFERENCE STANDARDS

- A. API STD 594 - Check Valves: Flanged, Lug Wafer, and Butt-Welding 2017.
- B. ASME B1.20.1 - Pipe Threads, General Purpose (Inch) 2013 (Reaffirmed 2018).
- C. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250 2015.
- D. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard 2017.
- E. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves 2017.
- F. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2018.
- G. ASME B16.34 - Valves - Flanged, Threaded and Welding End 2017.
- H. ASME B31.9 - Building Services Piping 2017.
- I. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing and Fusing Operators 2019.
- J. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings 2004 (Reapproved 2019).
- K. ASTM A536 - Standard Specification for Ductile Iron Castings 1984 (Reapproved 2014).
- L. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings 2017.

- M. MSS SP-45 - Bypass and Drain Connections 2003 (Reaffirmed 2008).
- N. MSS SP-67 - Butterfly Valves 2017.
- O. MSS SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends 2011.
- P. MSS SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends 2018.
- Q. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service 2010a.
- R. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves 2013.
- S. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010.
- T. MSS SP-125 - Gray Iron and Ductile Iron In-Line, Spring-Loaded, Center-Guided Check Valves 2018.
- U. NSF 61 - Drinking Water System Components - Health Effects 2019.
- V. NSF 372 - Drinking Water System Components - Lead Content 2016.

#### 1.5 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.
- E. Maintenance Materials: Furnish Owner with one wrench for every five plug valves, in each size of square plug valve head.
  - 1. See Section 016000 - Product Requirements, for additional provisions.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer:
  - 1. Obtain valves for each valve type from single manufacturer.
  - 2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Welding Materials and Procedures: Comply with ASME BPVC-IX.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
  - 2. Protect valve parts exposed to piped medium against rust and corrosion.
  - 3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
  - 4. Adjust globe, gate, and angle valves to the closed position to avoid clattering.
  - 5. Secure check valves in either the closed position or open position.
  - 6. Adjust butterfly valves to closed or partially closed position.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection and protect flanges and specialties from dirt.
    - a. Provide temporary inlet and outlet caps.
    - b. Maintain caps in place until installation.
  - 2. Store valves in shipping containers and maintain in place until installation.
    - a. Store valves indoors in dry environment.
    - b. Store valves off the ground in watertight enclosures when indoor storage is not an option.



**1.8 EXERCISE THE FOLLOWING PRECAUTIONS FOR HANDLING:**

- A. Handle large valves with sling, modified to avoid damage to exposed parts.
- B. Avoid the use of operating handles or stems as rigging or lifting points.

**PART 2 PRODUCTS****2.1 APPLICATIONS**

- A. See drawings for specific valve locations.
- B. Provide the following valves for the applications if not indicated on drawings:
  - 1. Shutoff: Ball, butterfly, gate.
  - 2. Dead-End: Single-flange butterfly (lug) type.
  - 3. Swing Check (Pump Outlet):
    - a. 2 NPS ( 50 DN ) and Smaller: Bronze swing check valves with bronze disc.
- C. Substitutions of valves with higher CWP classes or SWP ratings for same valve types are permitted when specified CWP ratings or SWP classes are not available.
- D. Required Valve End Connections for Non-Wafer Types:
  - 1. Copper Tube:
    - a. 2 NPS ( 50 DN ) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
    - b. 2-1/2 NPS ( 65 DN ) to 4 NPS ( 100 DN ): Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.
- E. Domestic, Hot and Cold Water Valves:
  - 1. 2 NPS ( 50 DN ) and Smaller:
    - a. Bronze and Brass: Provide with solder-joint ends.
    - b. Bronze Angle: Class 125, bronze disc.
    - c. Ball: Two piece, full port, brass with brass trim.
    - d. Bronze Swing Check: Class 125, bronze disc.
  - 2. 2-1/2 NPS ( 65 DN ) and Larger:
    - a. Iron, 2-1/2 NPS ( 65 DN ) to 4 NPS ( 100 DN ): Provide with threaded ends.
    - b. Iron Ball: Class 150.
    - c. Iron Single-Flange Butterfly: 200 CWP, EPDM seat, aluminum-bronze disc.
    - d. Iron Grooved-End Butterfly: 175 CWP.
    - e. Iron Swing Check: Class 125, metal seats.
    - f. Iron Swing Check with Closure Control: Class 125, lever and spring.
    - g. Iron Grooved-End Swing Check: 300 CWP.
    - h. Iron Center-Guided Check: Class 125, compact-wafer, metal seat.
    - i. Iron Plate-Type Check: Class 125; single plate; metal seat.
    - j. Iron Gate: Class 125, NRS.

**2.2 GENERAL REQUIREMENTS**

- A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.
- B. Valve Sizes: Match upstream piping unless otherwise indicated.
- C. Valve Actuator Types:
  - 1. Handwheel: Valves other than quarter-turn types.
  - 2. Hand Lever: Quarter-turn valves 6 NPS ( 150 DN ) and smaller except plug valves.

3. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator, of size and with chain for mounting height, as indicated in the "Valve Installation" Article.
  - D. Valves in Insulated Piping: With 2 NPS ( 50 DN ) stem extensions and the following features:
    1. Gate Valves: Rising stem.
    2. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
    3. Butterfly Valves: Extended neck.
  - E. Valve-End Connections:
    1. Threaded End Valves: ASME B1.20.1.
    2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
    3. Pipe Flanges and Flanged Fittings 1/2 NPS ( 15 DN ) through 24 NPS ( 600 DN ): ASME B16.5.
    4. Solder Joint Connections: ASME B16.18.
  - F. General ASME Compliance:
    1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
    2. Solder-joint Connections: ASME B16.18.
    3. Building Services Piping Valves: ASME B31.9.
  - G. Valve Materials for Potable Water: NSF 61 and NSF 372.
  - H. Bronze Valves:
    1. Fabricate from dezincification resistant material.
    2. Copper alloys containing more than 15 percent zinc are not permitted.
  - I. Valve Bypass and Drain Connections: MSS SP-45.
- 2.3 BRONZE ANGLE VALVES
- A. Class 125: CWP Rating: 200 psig ( 1380 kPa ).
    1. Comply with MSS SP-80, Type 1.
    2. Body: Bronze; ASTM B62, with integral seat and screw in bonnet.
    3. Ends: Threaded.
    4. Stem: Bronze.
    5. Disc: Bronze.
    6. Packing: Asbestos free.
    7. Handwheel: Bronze or aluminum.
- 2.4 BRASS BALL VALVES
- A. Two Piece, Full Port with Brass Trim:
    1. Comply with MSS SP-110.
    2. SWP Rating: 150 psig ( 1035 kPa ).
    3. CWP Rating: 600 psig ( 4140 kPa ).
    4. Body: Forged brass.
    5. Ends: Threaded.
    6. Seats: PTFE.
    7. Stem: Brass.
    8. Ball: Chrome-plated brass.
- 2.5 BRONZE BALL VALVES
- A. Two Piece, Standard Port with Bronze Trim:
    1. Comply with MSS SP-110.
    2. SWP Rating: 150 psig ( 1035 kPa ).

3. CWP Rating: 600 psig ( 4140 kPa ).
4. Body: Bronze.
5. Ends: Threaded.
6. Seats: PTFE.
7. Stem: Bronze.
8. Ball: Chrome plated brass.

## 2.6 IRON BALL VALVES

- A. Class 125, Full Port, Stainless Steel Trim:
  1. Comply with MSS SP-72.
  2. CWP Rating: 200 psig ( 1380 kPa ).
  3. Body: ASTM A536 Grade 65-45-12, ductile iron.
  4. Ends: Flanged.
  5. Seats: PTFE.
  6. Stem: Stainless steel.
  7. Ball: Stainless steel.
  8. Operator: Lever, with locking handle.

## 2.7 IRON, SINGLE FLANGE BUTTERFLY VALVES

- A. Lug type: Bi-directional dead-end service without use of downstream flange.
  1. Comply with MSS SP-67, Type I.
  2. CWP Rating: 200 psig ( 1380 kPa ).
  3. Body: ASTM A126, cast iron or ASTM A536, ductile iron.
  4. Stem: One or two-piece stainless steel.
  5. Seat: EPDM.
  6. Disc: Coated ductile iron.

## 2.8 IRON, GROOVED-END BUTTERFLY VALVES

- A. CWP Rating: 175 psig (1200 kPa).
  1. Comply with MSS SP-67, Type I.
  2. Body: Coated ductile iron.
  3. Stem: Two-piece stainless steel.
  4. Disc: Coated ductile iron.
  5. Disc Seal: EPDM.

## 2.9 BRONZE SWING CHECK VALVES

- A. Class 125: CWP Rating: 200 psig (1380 kPa).
  1. Comply with MSS SP-80, Type 3.
  2. Design: Horizontal flow.
  3. Body: Bronze, ASTM B62.
  4. Ends: Threaded as indicated.
  5. Disc: Bronze.

## 2.10 IRON SWING CHECK VALVES

- A. Class 125:
  1. Comply with MSS SP-71, Type I.
  2. CWP Rating: 200 psig ( 1380 kPa ).
  3. Design: Clear or full waterway.
  4. Body: ASTM A126, gray iron with bolted bonnet.
  5. Ends: Flanged as indicated.
  6. Trim: Composition.
  7. Seat Ring and Disc Holder: Bronze.
  8. Disc: PTFE.
  9. Gasket: Asbestos free.

## B. Class 250:

1. Comply with MSS SP-71, Type I.
2. CWP Rating: 500 psig ( 3450 kPa ).
3. Design: Clear or full waterway.
4. Body: ASTM A126, gray iron with bolted bonnet.
5. Ends: Flanged as indicated.
6. Trim: Bronze.
7. Metal Seat.
8. Gasket: Asbestos free.

## 2.11 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

## A. Class 125 with Lever and Spring-Closure Control.

1. Comply with MSS SP-71, Type I.
2. Description:
  - a. CWP Rating: 200 psig ( 1380 kPa ).
  - b. Design: Clear or full waterway.
  - c. Body: ASTM A126, gray iron with bolted bonnet.
  - d. Ends: Flanged as indicated.
  - e. Trim: Bronze.
  - f. Gasket: Asbestos free.
  - g. Closer Control: Factory installed, exterior lever, and weight.

## 2.12 IRON GROOVED-END SWING CHECK VALVES

## A. 300 CWP:

1. CWP Rating: 300 psig ( 2070 kPa ).
2. Body: ASTM A536, Grade 65-45-12 ductile iron.
3. Seal: EPDM.
4. Disc: Ductile iron.
5. Coating: Black, non-lead paint.

## 2.13 IRON CENTER-GUIDED CHECK VALVES

## A. Class 125, Compact-Wafer:

1. Comply with MSS SP-125.
2. CWP Rating: 200 psig ( 1380 kPa ).
3. Body: ASTM A126 gray iron.
4. Metal Seat: Unleaded bronze.

## 2.14 IRON PLATE TYPE CHECK VALVES

## A. Class 125 Single-Plate:

1. Comply with API STD 594.
2. CWP Rating: 200 psig ( 1380 kPa ).
3. Design: Wafer, spring-loaded plate.
4. Body: ASTM A126, gray iron.
5. Resilient Seat: EPDM.

## 2.15 IRON GATE VALVES

## A. NRS or OS &amp; Y:

1. Comply with MSS SP-70, Type I.
2. Class 125: CWP Rating: 200 psig ( 1380 kPa ).
3. Body: ASTM A126, gray iron with bolted bonnet.
4. Ends: Flanged.
5. Trim: Bronze.
6. Disc: Solid wedge.
7. Packing and Gasket: Asbestos free.

## 2.16 CHAINWHEELS

- A. Description: Valve actuation assembly with sprocket rim, brackets, and chain.
  - 1. Brackets: Type, number, size, and fasteners required to mount actuator on valve.
  - 2. Attachment: For connection to ball and butterfly valve stems.
  - 3. Sprocket Rim with Chain Guides: Ductile iron. Include zinc coating.
  - 4. Chain: Hot-dip galvanized steel. Sized to fit sprocket rim.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result in leakage.
- B. Verify valve parts to be fully operational in all positions from closed to fully open.
- C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.
- D. Should valve is determined to be defective, replace with new valve.

### 3.2 INSTALLATION

- A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.
- B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.
- C. Where valve support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
- D. Install check valves where necessary to maintain direction of flow as follows:
  - 1. Lift Check: Install with stem plumb and vertical.
  - 2. Swing Check: Install horizontal maintaining hinge pin level.
  - 3. Orient plate-type and center-guided into horizontal or vertical position, between flanges.
- E. Provide chainwheels on operators for valves 4 NPS ( 100 DN ) and larger where located 96 NPS ( 2400 DN ) or more above finished floor, terminating 60 NPS ( 1520 DN ) above finished floor.

END OF SECTION

## SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Support and attachment components for equipment, piping, and other plumbing work.

#### 1.2 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.

#### 1.3 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General - Purpose Piping 2014.
- D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.
- E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2018).
- F. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2019.
- G. MFMA-4 - Metal Framing Standards Publication 2004.
- H. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
  - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
  - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
  - 4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
  - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
  - 1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 033000.

#### 1.5 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, non-penetrating rooftop supports, post-installed concrete and masonry anchors and thermal insulated pipe supports.

#### 1.6 QUALITY ASSURANCE

- A. Comply with applicable building code.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

## PART 2 PRODUCTS

### 2.1 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
  - 1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
  - 2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
  - 3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of [\_\_\_\_]. Include consideration for vibration, equipment operation, and shock loads where applicable.
  - 4. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
    - a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
    - b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Metal Channel (Strut) Framing Systems:
  - 1. Comply with MFMA-4.
- C. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
  - 1. Minimum Size, Unless Otherwise Indicated or Required:
    - a. Equipment Supports: 1/2 inch ( 13 mm ) diameter.
    - b. Piping up to 1 inch (27 mm) nominal: 1/4 inch ( 6 mm ) diameter.
    - c. Piping larger than 1 inch (27 mm) nominal: 3/8 inch ( 10 mm ) diameter.
- D. Pipe Supports:
  - 1. Liquid Temperatures Up To 122 degrees F ( 50 degrees C ):
    - a. Overhead Support: MSS SP-58 Types 1, 3 through 12.
    - b. Support From Below: MSS SP-58 Types 35 through 38.
- E. Beam Clamps: MSS SP-58 Types 19 through 23, 25 or 27 through 30 based on required load.
  - 1. Material: ASTM A36/A36M carbon steel or ASTM A181/A181M forged steel.
  - 2. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.
- F. Offset Pipe Clamps: Double-leg design two-piece pipe clamp.
- G. Strut Clamps: Two-piece pipe clamp.
- H. Pipe Hangers: For a given pipe run use hangers of the same type and material.
  - 1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
  - 2. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.
- I. Anchors and Fasteners:
  - 1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.

- B. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.
- C. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- D. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- E. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- F. Equipment Support and Attachment:
  - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
  - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
  - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
  - 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- G. Secure fasteners according to manufacturer's recommended torque settings.
- H. Remove temporary supports.

END OF SECTION



## SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Stencils.
- D. Pipe markers.
- E. Ceiling tacks.

## 1.2 RELATED REQUIREMENTS

- A. Section 099123 - Interior Painting: Identification painting.

## 1.3 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems 2015.

## 1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- C. Project Record Documents: Record actual locations of tagged valves.

## PART 2 PRODUCTS

## 2.1 IDENTIFICATION APPLICATIONS

- A. Instrumentation: Tags.
- B. Piping: Tags.
- C. Pumps: Nameplates.
- D. Small-sized Equipment: Tags.
- E. Valves: Tags and ceiling tacks where located above lay-in ceiling.

## 2.2 NAMEPLATES

- A. Manufacturers:
  - 1. Brimar Industries, Inc; [ ]: [www.pipemarker.com/#sle](http://www.pipemarker.com/#sle).
  - 2. Substitutions: See Section 016000 - Product Requirements.
- B. Description: Laminated three-layer plastic with engraved letters.
  - 1. Letter Color: White.
  - 2. Letter Height: 1/4 inch ( 6 mm ).
  - 3. Background Color: Black.
  - 4. Plastic: Comply with ASTM D709.

## 2.3 TAGS

- A. Manufacturers:
  - 1. Advanced Graphic Engraving; [ ]: [www.advancedgraphicengraving.com/#sle](http://www.advancedgraphicengraving.com/#sle).
  - 2. Brady Corporation; [ ]: [www.bradycorp.com/#sle](http://www.bradycorp.com/#sle).
  - 3. Brimar Industries, Inc; [ ]: [www.pipemarker.com/#sle](http://www.pipemarker.com/#sle).
  - 4. Kolbi Pipe Marker Co; [ ]: [www.kolbipipemarkers.com/#sle](http://www.kolbipipemarkers.com/#sle).
  - 5. Seton Identification Products; [ ]: [www.seton.com/#sle](http://www.seton.com/#sle).
  - 6. Substitutions: See Section 016000 - Product Requirements.
- B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch ( 40 mm ) diameter with smooth edges.
- C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

## 2.4 STENCILS

- A. Manufacturers:
  - 1. Brady Corporation; [ ]: [www.bradycorp.com/#sle](http://www.bradycorp.com/#sle).
  - 2. Kolbi Pipe Marker Co.; [ ]: [www.kolbipipemarkers.com/#sle](http://www.kolbipipemarkers.com/#sle).

3. Seton Identification Products; [ ]: [www.seton.com/#sle](http://www.seton.com/#sle).
4. Substitutions: See Section 016000 - Product Requirements.
- B. Stencils: With clean cut symbols and letters of following size:
  1. 3/4 to 1-1/4 inch ( 20-30 mm ) Outside Diameter of Insulation or Pipe: 8 inch ( 200 mm ) long color field, 1/2 inch ( 15 mm ) high letters.
  2. 1-1/2 to 2 inch ( 40-50 mm ) Outside Diameter of Insulation or Pipe: 8 inch ( 200 mm ) long color field, 3/4 inch ( 20 mm ) high letters.
  3. 2-1/2 to 6 inch ( 65-150 mm ) Outside Diameter of Insulation or Pipe: 12 inch ( 300 mm ) long color field, 1-1/4 inch ( 30 mm ) high letters.
  4. 8 to 10 inch ( 200-250 mm ) Outside Diameter of Insulation or Pipe: 24 inch ( 600 mm ) long color field, 2-1/2 inch ( 65 mm ) high letters.
- C. Stencil Paint: As specified in Section 099123, semi-gloss enamel, colors complying with ASME A13.1.

## 2.5 PIPE MARKERS

- A. Manufacturers:
  1. Brady Corporation; [ ]: [www.bradycorp.com/#sle](http://www.bradycorp.com/#sle).
  2. Brimar Industries, Inc; [ ]: [www.pipemarker.com/#sle](http://www.pipemarker.com/#sle).
  3. Kolbi Pipe Marker Co; [ ]: [www.kolbipipemarkers.com/#sle](http://www.kolbipipemarkers.com/#sle).
  4. MIFAB, Inc; [ ]: [www.mifab.com/#sle](http://www.mifab.com/#sle).
  5. Seton Identification Products; [ ]: [www.seton.com/#sle](http://www.seton.com/#sle).
  6. Substitutions: See Section 016000 - Product Requirements.
- B. Comply with ASME A13.1.
- C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- E. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches ( 150 mm ) wide by 4 mil ( 0.10 mm ) thick, manufactured for direct burial service.
- F. Color code as follows:
  1. Potable, Cooling, Boiler, Feed, Other Water: Green with white letters.
  2. Fire Quenching Fluids: Red with white letters.
  3. Flammable Fluids: Yellow with black letters.
  4. Combustible Fluids: Brown with white letters.

## 2.6 CEILING TACKS

- A. Manufacturers:
  1. Substitutions: See Section 016000 - Product Requirements.
- B. Description: Steel with 3/4 inch ( 20 mm ) diameter color coded head.
- C. Color code as follows:
  1. Plumbing Valves: Green.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Section 099123 for stencil painting.

### 3.2 INSTALLATION

- A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

- B. Install tags with corrosion resistant chain.
- C. Apply stencil painting in accordance with Section 099123.
- D. Install plastic pipe markers in accordance with manufacturer's instructions.
- E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- F. Install underground plastic pipe markers 6 to 8 inches ( 150 to 200 mm ) below finished grade, directly above buried pipe.
- G. Use tags on piping 3/4 inch ( 20 mm ) diameter and smaller.
  - 1. Identify service, flow direction, and pressure.
  - 2. Install in clear view and align with axis of piping.
  - 3. Locate identification not to exceed 20 feet ( 6 m ) on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.
- H. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings.  
Locate in corner of panel closest to equipment.

END OF SECTION

## SECTION 220719 - PLUMBING PIPING INSULATION

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Piping insulation.
- B. Jackets and accessories.

## 1.2 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.
- B. Section 099113 - Exterior Painting: Painting insulation jacket.
- C. Section 099123 - Interior Painting: Painting insulation jacket.
- D. Section 221005 - Plumbing Piping: Placement of hangers and hanger inserts.

## 1.3 REFERENCE STANDARDS

- A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus 2019.
- D. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement 2007 (Reapproved 2013).
- E. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation 2019.
- F. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel 2008 (Reapproved 2018).
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.
- H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.
- I. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

## 1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

## 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

## PART 2 PRODUCTS

## 2.1 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

## 2.2 GLASS FIBER

- A. Manufacturers:
  - 1. CertainTeed Corporation; [ ]: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
  - 2. Johns Manville Corporation; [ ]: [www.jm.com/#sle](http://www.jm.com/#sle).

3. Knauf Insulation; Earthwool 1000 Degree Pipe Insulation:  
[www.knaufinsulation.com/#sle](http://www.knaufinsulation.com/#sle).
4. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ:  
[www.ocbuildingspec.com/#sle](http://www.ocbuildingspec.com/#sle).
5. Owens Corning Corporation; VaporWick Pipe Insulation:  
[www.ocbuildingspec.com/#sle](http://www.ocbuildingspec.com/#sle).
6. Substitutions: See Section 016000 - Product Requirements.
- B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible, with wicking material to transport condensed water to the outside of the system for evaporation to the atmosphere.
  1. K ( Ksi ) Value: ASTM C177, 0.23 at 75 degrees F ( 0.034 at 24 degrees C ).
  2. Maximum Service Temperature: 220 degrees F ( 104 degrees C ).
  3. Maximum Moisture Absorption: 0.2 percent by volume.
- C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches ( 0.029 ng/Pa s m ).
- D. Tie Wire: 0.048 inch ( 1.22 mm ) stainless steel with twisted ends on maximum 12 inch ( 300 mm ) centers.
- E. Vapor Barrier Lap Adhesive: Compatible with insulation.
- F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.
- G. Fibrous Glass Fabric:
  1. Cloth: Untreated; 9 oz/sq yd ( 305 g/sq m ) weight.
  2. Blanket: 1.0 lb/cu ft ( 16 kg/cu m ) density.
  3. Weave: 5 by 5.
- H. Indoor Vapor Barrier Finish:
  1. Cloth: Untreated; 9 oz/sq yd ( 305 g/sq m ) weight.
  2. Vinyl emulsion type acrylic, compatible with insulation, black color.
- I. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

## 2.3 JACKETS

- A. PVC Plastic.
  1. Manufacturers:
    - a. Johns Manville Corporation; [\_\_\_\_]: [www.jm.com/#sle](http://www.jm.com/#sle).
    - b. Substitutions: See Section 016000 - Product Requirements.
  2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
    - a. Minimum Service Temperature: 0 degrees F ( Minus 18 degrees C ).
    - b. Maximum Service Temperature: 150 degrees F ( 66 degrees C ).
    - c. Moisture Vapor Permeability: 0.002 perm inch ( 0.0029 ng/Pa s m ), maximum, when tested in accordance with ASTM E96/E96M.
    - d. Thickness: 10 mil ( 0.25 mm ).
    - e. Connections: Brush on welding adhesive.
  3. Covering Adhesive Mastic: Compatible with insulation.
- B. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
  1. Thickness: 0.016 inch ( 0.40 mm ) sheet.
  2. Finish: Smooth.
  3. Joining: Longitudinal slip joints and 2 inch ( 50 mm ) laps.
  4. Fittings: 0.016 inch ( 0.4 mm ) thick die shaped fitting covers with factory attached protective liner.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

### 3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.
- C. Exposed Piping: Locate insulation and cover seams in least visible locations.
- D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- E. Install cellular melamine with factory-applied jackets with a manufacturer-approved adhesive along seams, both straight lap joints and circumferential lap joints.
  - 1. Install seal over seams with factory-approved room temperature vulcanization (RTV) silicone sealant to ensure a positive vapor barrier seal in outdoor and sanitary washdown environments.
- F. Glass fiber insulated pipes conveying fluids below ambient temperature:
  - 1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
  - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- G. For hot piping conveying fluids 140 degrees F ( 60 degrees C ) or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- H. Glass fiber insulated pipes conveying fluids above ambient temperature:
  - 1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
  - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- I. Inserts and Shields:
  - 1. Application: Piping 1-1/2 inches ( 40 mm ) diameter or larger.
  - 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
  - 3. Insert Location: Between support shield and piping and under the finish jacket.
  - 4. Insert Configuration: Minimum 6 inches ( 150 mm ) long, of same thickness and contour as adjoining insulation; may be factory fabricated.
  - 5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- J. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 078400.
- K. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet ( 3 meters ) above finished floor): Finish with canvas jacket sized for finish painting.

- L. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping.

### 3.3 SCHEDULES

#### A. Plumbing Systems:

- 1. Domestic Hot Water Supply:
    - a. Glass Fiber Insulation:
      - 1) Pipe Size Range: 1/2 to 2 inch ( 12.7 to 25.4 mm ).
      - 2) Thickness: [1/2 CW, 1 HW] inch ( [ ] mm )
      - 3) Pipe Size Range: 1-1/4 inch (31.75 mm) and larger.
      - 4) Thickness: 1 inch (25.4 mm)
  - 2. Roof Drainage Above Grade: All horizontal piping above finished ceilings.
- END OF SECTION

## SECTION 221005 - PLUMBING PIPING

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Pipe, pipe fittings, specialties, and connections for piping systems.
  - 1. Sanitary sewer.
  - 2. Domestic water.
  - 3. Storm water.
  - 4. Flanges, unions, and couplings.
  - 5. Pipe hangers and supports.
  - 6. Valves.
  - 7. Flow controls.
  - 8. Check.
  - 9. Water pressure reducing valves.
  - 10. Relief valves.
  - 11. Strainers.

## 1.2 RELATED REQUIREMENTS

- A. Section 099113 - Exterior Painting.
- B. Section 099123 - Interior Painting.
- C. Section 220516 - Expansion Fittings and Loops for Plumbing Piping.
- D. Section 220548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.
- E. Section 220553 - Identification for Plumbing Piping and Equipment.
- F. Section 220719 - Plumbing Piping Insulation.
- G. Section 312316 - Excavation.
- H. Section 312316.13 - Trenching.
- I. Section 312323 - Fill.
- J. Section 330110.58 - Disinfection of Water Utility Piping Systems.

## 1.3 REFERENCE STANDARDS

- A. ANSI Z21.22 - American National Standard for Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems 2015.
- B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2016.
- C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2018.
- D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2018.
- E. ASME B31.1 - Power Piping 2018.
- F. ASME B31.9 - Building Services Piping 2017.
- G. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers 2019.
- H. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing and Fusing Operators 2019.
- I. ASSE 1003 - Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems 2009.
- J. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2018.
- K. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings 2020.
- L. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.



- M. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2019.
- N. ASTM B32 - Standard Specification for Solder Metal 2008 (Reapproved 2014).
- O. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes 2015a.
- P. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2016.
- Q. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric) 2018.
- R. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube 2016.
- S. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings 2016.
- T. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings 2020.
- U. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems 2012 (Reapproved 2018).
- V. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings 2014.
- W. ASTM D2855 - Standard Practice for the Two-Step (Primer & Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets 2015.
- X. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings 2016.
- Y. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe 2014.
- Z. ASTM F679 - Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings 2016.
- AA. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems 2010.
- BB. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings 2017.
- CC. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast 2017, with Errata (2018).
- DD. AWWA C550 - Protective Interior Coatings for Valves and Hydrants 2017.
- EE. AWWA C651 - Disinfecting Water Mains 2014.
- FF. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications 2017 (Revised 2018).
- GG. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements 2015.
- HH. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements 2016.
- II. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018.
- JJ. MSS SP-67 - Butterfly Valves 2017.
- KK. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010.
- LL. NSF 61 - Drinking Water System Components - Health Effects 2019.
- MM. NSF 372 - Drinking Water System Components - Lead Content 2016.

#### 1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
- C. Welder Certificate: Include welders certification of compliance with ASME BPVC-IX.
- D. Shop Drawings: For non-penetrating rooftop supports, submit detailed layout developed for this project, with design calculations for loadings and spacings.
- E. Project Record Documents: Record actual locations of valves.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Valve Repacking Kits: One for each type and size of valve.

#### 1.5 QUALITY ASSURANCE

- A. Perform work in accordance with applicable codes.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.
- D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.
- E. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

#### 1.7 FIELD CONDITIONS

- A. Do not install underground piping when bedding is wet or frozen.

### PART 2 PRODUCTS

#### 2.1 GENERAL REQUIREMENTS

- A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

#### 2.2 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET ( 1500 MM ) OF BUILDING

- A. PVC Pipe: ASTM D2665, ASTM D3034, or ASTM F679.
  - 1. Fittings: PVC.
  - 2. Joints: Push-on, using ASTM F477 elastomeric gaskets.

#### 2.3 SANITARY SEWER PIPING, ABOVE GRADE

- A. PVC Pipe: ASTM D2665.
  - 1. Fittings: PVC.
  - 2. Joints: Solvent welded, with ASTM D2564 solvent cement.

#### 2.4 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET ( 1500 MM ) OF BUILDING

- A. Copper Pipe: ASTM B42, hard drawn.
  - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.

2. Joints: ASTM B32, alloy Sn95 solder.
- B. Ductile Iron Pipe: AWWA C151/A21.51.
  1. Fittings: Ductile or gray iron, standard thickness.
  2. Joints: AWWA C111/A21.11, styrene butadiene rubber (SBR) or vulcanized SBR gasket with 3/4 inch ( 19 mm ) diameter rods.
- 2.5 DOMESTIC WATER PIPING, ABOVE GRADE
  - A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
    1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
    2. Joints: ASTM B32, alloy Sn95 solder.
- 2.6 STORM WATER PIPING, BURIED WITHIN 5 FEET ( 1500 MM ) OF BUILDING
  - A. Cast Iron Pipe: ASTM A74 extra heavy weight.
    1. Fittings: Cast iron.
    2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.
- 2.7 STORM WATER PIPING, ABOVE GRADE
  - A. Cast Iron Pipe: CISPI 301, hubless, service weight.
    1. Fittings: Cast iron.
    2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.
- 2.8 NATURAL GAS PIPING, BURIED WITHIN 5 FEET ( 1500 MM ) OF BUILDING
  - A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
    1. Fittings: ASTM A234/A234M, wrought steel welding type.
    2. Joints: ASME B31.1, welded.
    3. Jacket: AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil ( 0.25 mm ) polyethylene tape.
- 2.9 NATURAL GAS PIPING, ABOVE GRADE
  - A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
    1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
    2. Joints: Threaded or welded to ASME B31.1.
- 2.10 FLANGES, UNIONS, AND COUPLINGS
  - A. Unions for Pipe Sizes 3 Inches ( 80 mm ) and Under:
    1. Ferrous pipe: Class 150 malleable iron threaded unions.
    2. Copper tube and pipe: Class 150 bronze unions with soldered joints.
  - B. Flanges for Pipe Size Over 1 Inch ( 25 mm ):
    1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
    2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.
  - C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.
- 2.11 PIPE HANGERS AND SUPPORTS
  - A. Provide hangers and supports that comply with MSS SP-58.
    1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
    2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
    3. Trapeze Hangers: Welded steel channel frames attached to structure.
    4. Vertical Pipe Support: Steel riser clamp.

5. Floor Supports: Concrete pier or steel pedestal with floor flange; fixture attachment.
  6. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:
    - a. Bases: High density polypropylene.
    - b. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
    - c. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
    - d. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.
    - e. Height: Provide minimum clearance of 6 inches ( 150 mm ) under pipe to top of roofing.
    - f. Manufacturers:
      - 1) PHP Systems/Design; [ ]: [www.phpsd.com/#sle](http://www.phpsd.com/#sle).
      - 2) Substitutions: See Section 016000 - Product Requirements.
- B. Plumbing Piping - Drain, Waste, and Vent:
1. Hangers for Pipe Sizes 1/2 Inch ( 15 mm ) to 1-1/2 Inches ( 40 mm ): Malleable iron, adjustable swivel, split ring.
  2. Hangers for Pipe Sizes 2 Inches ( 50 mm ) and Over: Carbon steel, adjustable, clevis.
  3. Wall Support for Pipe Sizes to 3 Inches ( 80 mm ): Cast iron hook.
  4. Wall Support for Pipe Sizes 4 Inches ( 100 mm ) and Over: Welded steel bracket and wrought steel clamp.
  5. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
  6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- C. Plumbing Piping - Water:
1. Hangers for Pipe Sizes 1/2 Inch ( 15 mm ) to 1-1/2 Inches ( 40 mm ): Malleable iron, adjustable swivel, split ring.
  2. Hangers for Cold Pipe Sizes 2 Inches ( 50 mm ) and Over: Carbon steel, adjustable, clevis.
  3. Hangers for Hot Pipe Sizes 2 Inches ( 50 mm ) to 4 Inches ( 100 mm ): Carbon steel, adjustable, clevis.
  4. Wall Support for Pipe Sizes to 3 Inches ( 80 mm ): Cast iron hook.
  5. Wall Support for Pipe Sizes 4 Inches ( 100 mm ) and Over: Welded steel bracket and wrought steel clamp.
  6. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
  7. Floor Support for Hot Pipe Sizes to 4 Inches ( 100 mm ): Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.
  8. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
  2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.

3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.
6. Other Types: As required.
7. Manufacturers:
  - a. Powers Fasteners, Inc; [ ]: [www.powers.com/#sle](http://www.powers.com/#sle).
  - b. Substitutions: See Section 016000 - Product Requirements.

## 2.12 BALL VALVES

- A. Manufacturers:
  1. Apollo Valves; [ ]: [www.apollovalves.com/#sle](http://www.apollovalves.com/#sle).
  2. Nibco, Inc; [ ]: [www.nibco.com/#sle](http://www.nibco.com/#sle).
  3. Substitutions: See Section 016000 - Product Requirements.
- B. Construction, 4 Inches ( 100 mm ) and Smaller: MSS SP-110, Class 150, 400 psi ( 2760 kPa ) CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, threaded or grooved ends with union.

## 2.13 BUTTERFLY VALVES

- A. Manufacturers:
  1. Apollo Valves; [ ]: [www.apollovalves.com/#sle](http://www.apollovalves.com/#sle).
  2. Crane Company; [ ]: [www.cranecpe.com/#sle](http://www.cranecpe.com/#sle).
  3. Substitutions: See Section 016000 - Product Requirements.
- B. Construction 1-1/2 Inches ( 40 mm ) and Larger: MSS SP-67, 200 psi ( 1380 kPa ) CWP, cast or ductile iron body, nickel-plated ductile iron disc, resilient replaceable EPDM seat, wafer ends, extended neck, 10 position lever handle.
- C. Provide gear operators for valves 8 inches ( 150 mm ) and larger, and chain-wheel operators for valves mounted over 8 feet ( 2400 mm ) above floor.

## 2.14 WATER PRESSURE REDUCING VALVES

- A. Manufacturers:
  1. Amtrol Inc; [ ]: [www.amtrol.com/#sle](http://www.amtrol.com/#sle).
  2. Apollo Valves; [ ]: [www.apollovalves.com/#sle](http://www.apollovalves.com/#sle).
  3. Watts Regulator Company; [ ]: [www.wattsregulator.com/#sle](http://www.wattsregulator.com/#sle).
- B. Up to 2 Inches ( 50 mm ):
  1. ASSE 1003, bronze body, stainless steel, and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.
- C. Over 2 Inches ( 50 mm ):
  1. ASSE 1003, cast iron body with interior lining complying with AWWA C550, bronze fitted, elastomeric diaphragm and seat disc, flanged.

## 2.15 RELIEF VALVES

- A. Pressure:
  1. Manufacturers:
    - a. Cla-Val Co; Model [ ]: [www.cla-val.com/#sle](http://www.cla-val.com/#sle).
    - b. Henry Technologies; Model [ ]: [www.henrytech.com/#sle](http://www.henrytech.com/#sle).
    - c. Watts Regulator Company; Model [ ]: [www.wattsregulator.com/#sle](http://www.wattsregulator.com/#sle).
    - d. Substitutions: See Section 016000 - Product Requirements.
  2. ANSI Z21.22, AGA certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.
- B. Temperature and Pressure:
  1. Manufacturers:

- a. Cla-Val Co; Model [\_\_\_\_]: [www.cla-val.com/#sle](http://www.cla-val.com/#sle).
  - b. Henry Technologies; Model [\_\_\_\_]: [www.henrytech.com/#sle](http://www.henrytech.com/#sle).
  - c. Watts Regulator Company; Model [\_\_\_\_]:  
[www.wattsregulator.com/#sle](http://www.wattsregulator.com/#sle).
  - d. Substitutions: See Section 016000 - Product Requirements.
2. ANSI Z21.22, AGA certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F ( 98.9 degrees C ), capacity ASME BPVC-IV certified and labelled.

## 2.16 STRAINERS

- A. Manufacturers:
  1. Armstrong International, Inc; Model [\_\_\_\_]:  
[www.armstronginternational.com/#sle](http://www.armstronginternational.com/#sle).
  2. Green Country Filter Manufacturing; Model [\_\_\_\_]:  
[www.greencountryfilter.com/#sle](http://www.greencountryfilter.com/#sle).
  3. WEAMCO; Model [\_\_\_\_]: [www.weamco.com/#sle](http://www.weamco.com/#sle).
  4. Substitutions: See Section 016000 - Product Requirements.
- B. Size 2 inch ( 50 mm ) and Under:
  1. Threaded brass body for 175 psi ( 1200 kPa ) CWP, Y pattern with 1/32 inch ( 0.8 mm ) stainless steel perforated screen.
  2. Class 150, threaded bronze body 300 psi ( 2070 kPa ) CWP, Y pattern with 1/32 inch ( 0.8 mm ) stainless steel perforated screen.
- C. Size 1-1/2 inch ( 40 mm ) to 4 inch ( 100 mm ):
  1. Class 125, flanged iron body, Y pattern with 1/16 inch ( 1.6 mm ) stainless steel perforated screen.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

### 3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

### 3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 220516.
- G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
  1. Refer to Section 220719.
- H. Provide access where valves and fittings are not exposed.
- I. Establish elevations of buried piping outside the building to ensure not less than 2 ft ( 0.61 m ) of cover.
- J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

- K. Provide support for utility meters in accordance with requirements of utility companies.
- L. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
  - 1. Painting of interior plumbing systems and components is specified in Section 099123.
  - 2. Painting of exterior plumbing systems and components is specified in Section 099113.
- M. Excavate in accordance with Section 312316.
- N. Backfill in accordance with Section 312323.
- O. Install bell and spigot pipe with bell end upstream.
- P. Install valves with stems upright or horizontal, not inverted. Refer to Section 220523.
- Q. Install water piping to ASME B31.9.
- R. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.
- S. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.
- T. Sleeve pipes passing through partitions, walls and floors.
- U. Inserts:
  - 1. Provide inserts for placement in concrete formwork.
  - 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
  - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches ( 100 mm ).
  - 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
  - 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
- V. Pipe Hangers and Supports:
  - 1. Install in accordance with ASME B31.9.
  - 2. Support horizontal piping as indicated.
  - 3. Install hangers to provide minimum 1/2 inch ( 15 mm ) space between finished covering and adjacent work.
  - 4. Place hangers within 12 inches ( 300 mm ) of each horizontal elbow.
  - 5. Use hangers with 1-1/2 inch ( 40 mm ) minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
  - 6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
  - 7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
  - 8. Provide copper plated hangers and supports for copper piping.
  - 9. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
    - a. Painting of interior plumbing systems and components is specified in Section 099123.
    - b. Painting of exterior plumbing systems and components is specified in Section 099113.

10. Provide hangers adjacent to motor driven equipment with vibration isolation; refer to Section 220548.
11. Support cast iron drainage piping at every joint.

### 3.4 APPLICATION

- A. Use grooved mechanical couplings and fasteners only in accessible locations.
- B. Install unions downstream of valves and at equipment or apparatus connections.
- C. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.
- D. Install gate or ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
- E. Install globe valves for throttling, bypass, or manual flow control services.
- F. Provide spring loaded check valves on discharge of water pumps.

### 3.5 TOLERANCES

- A. Drainage Piping: Establish invert elevations within 1/2 inch ( 10 mm ) vertically of location indicated and slope to drain at minimum of 1/4 inch per foot ( 1:50 ) slope.
- B. Water Piping: Slope at minimum of 1/32 inch per foot ( 1:400 ) and arrange to drain at low points.

### 3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Disinfect water distribution system in accordance with Section 330110.58.
- B. Prior to starting work, verify system is complete, flushed and clean.
- C. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- D. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.
- E. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
- F. Maintain disinfectant in system for 24 hours.
- G. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- H. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- I. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

### 3.7 SERVICE CONNECTIONS

- A. Provide new sanitary and storm sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.
- B. Provide new water service complete with approved reduced pressure backflow preventer and water meter with by-pass valves, and sand strainer.
  1. Provide sleeve in wall for service main and support at wall with reinforced concrete bridge. Calk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.
  2. Provide 18 gage, 0.0478 inch ( 1.21 mm ) galvanized sheet metal sleeve around service main to 6 inch ( 150 mm ) above floor and 6 feet ( 1800 mm ) minimum below grade. Size for minimum of 2 inches ( 50 mm ) of loose batt insulation stuffing.

### 3.8 SCHEDULES

- A. Pipe Hanger Spacing:
  1. Metal Piping:



- a. Pipe Size: 1/2 inches ( 15 mm ) to 1-1/4 inches ( 32 mm ):
    - 1) Maximum Hanger Spacing: 6.5 ft ( 2 m ).
    - 2) Hanger Rod Diameter: 3/8 inches ( 9 mm ).
  - b. Pipe Size: 1-1/2 inches ( 40 mm ) to 2 inches ( 50 mm ):
    - 1) Maximum Hanger Spacing: 10 ft ( 3 m ).
    - 2) Hanger Rod Diameter: 3/8 inch ( 9 mm ).
  - c. Pipe Size: 2-1/2 inches ( 65 mm ) to 3 inches ( 75 mm ):
    - 1) Maximum Hanger Spacing: 10 ft ( 3 m ).
    - 2) Hanger Rod Diameter: 1/2 inch ( 13 mm ).
  - d. Pipe Size: 4 inches ( 100 mm ) to 6 inches ( 150 mm ):
    - 1) Maximum Hanger Spacing: 10 ft ( 3 m ).
    - 2) Hanger Rod Diameter: 5/8 inch ( 15 mm ).
  - e. Pipe Size: 8 inches ( 200 mm ) to 12 inches ( 300 mm ):
    - 1) Maximum hanger spacing: 14 ft ( 4.25 m ).
    - 2) Hanger Rod Diameter: 7/8 inch ( 22 mm ).
2. Plastic Piping:
- a. All Sizes:
    - 1) Maximum Hanger Spacing: 6 ft ( 1.8 m ).
    - 2) Hanger Rod Diameter: 3/8 inch ( 9 mm ).

END OF SECTION

## SECTION 221006 - PLUMBING PIPING SPECIALTIES

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Drains.
- B. Cleanouts.
- C. Hose bibbs.
- D. Hydrants.
- E. Backflow preventers.
- F. Water hammer arrestors.

## 1.2 RELATED REQUIREMENTS

- A. Section 016000 - Product Requirements: Procedures for Owner-supplied products.
- B. Section 221005 - Plumbing Piping.
- C. Section 223000 - Plumbing Equipment.
- D. Section 224000 - Plumbing Fixtures.

## 1.3 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- B. ASME A112.6.3 - Floor and Trench Drains 2019.
- C. ASME A112.6.4 - Roof, Deck, and Balcony Drains 2008 (Reaffirmed 2012).
- D. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers 2017.
- E. ASSE 1012 - Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent 2009.
- F. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers 2011.
- G. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance 2011 (Reaffirmed 2016).
- H. ASTM C478 - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections 2019.
- I. NSF 61 - Drinking Water System Components - Health Effects 2019.
- J. NSF 372 - Drinking Water System Components - Lead Content 2016.
- K. PDI-WH 201 - Water Hammer Arresters 2017.

## 1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- C. Operation Data: Indicate frequency of treatment required for interceptors.
- D. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

## 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept specialties on site in original factory packaging. Inspect for damage.

## PART 2 PRODUCTS

## 2.1 GENERAL REQUIREMENTS

- A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

## 2.2 DRAINS

### A. Manufacturers:

1. Jay R. Smith Manufacturing Company; [ ]: [www.jayrsmith.com/#sle](http://www.jayrsmith.com/#sle).
2. Josam Company; [ ]: [www.josam.com/#sle](http://www.josam.com/#sle).
3. Zurn Industries, LLC; [ ]: [www.zurn.com/#sle](http://www.zurn.com/#sle).
4. Substitutions: See Section 016000 - Product Requirements.

### B. Roof Drains:

1. Body: Galvanized cast iron with sump.
2. Strainer: Removable cast aluminum dome with vandal proof screws.
3. Accessories: Coordinate with roofing type, refer to Section [ ]:
  - a. Membrane flange and membrane clamp with integral gravel stop.
  - b. Waterproofing flange.
4. Manufacturers:
  - a. Jay R. Smith Manufacturing Company; [ ]: [www.jrsmith.com/#sle](http://www.jrsmith.com/#sle).
  - b. Substitutions: See Section 016000 - Product Requirements.

### C. Parapet Drains:

1. Lacquered cast iron body with aluminum flashing clamp collar and epoxy coated sloping grate.

### D. Roof Overflow Drains:

1. Galvanized cast iron body and clamp collar and bottom clamp ring; pipe extended to [ ] inches ( [ ] mm ) above flood elevation.

### E. Downspout Nozzles:

1. Bronze round with straight bottom section.

### F. Floor Drain (FD-1):

1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable nickel-bronze strainer.

### G. Floor Drain (FD-2):

1. ASME A112.6.3; lacquered cast iron or stainless steel, two piece body with double drainage flange, weep holes, reversible clamping collar, and round, adjustable round nickel bronze strainer with removable perforated sediment bucket.

## 2.3 CLEANOUTS

### A. Manufacturers:

1. Jay R. Smith Manufacturing Company; [ ]: [www.jayrsmith.com/#sle](http://www.jayrsmith.com/#sle).
2. Josam Company; [ ]: [www.josam.com/#sle](http://www.josam.com/#sle).
3. Zurn Industries, LLC; [ ]: [www.zurn.com/#sle](http://www.zurn.com/#sle).
4. Substitutions: See Section 016000 - Product Requirements.

## 2.4 HOSE BIBBS

### A. Manufacturers:

1. Jay R. Smith Manufacturing Company; [ ]: [www.jayrsmith.com/#sle](http://www.jayrsmith.com/#sle).
2. Murdock Manufacturing, Inc; [ ]: [www.murdockmfg.com/#sle](http://www.murdockmfg.com/#sle).
3. Watts Regulator Company; [ ]: [www.wattsregulator.com/#sle](http://www.wattsregulator.com/#sle).
4. Zurn Industries, LLC; [ ]: [www.zurn.com/#sle](http://www.zurn.com/#sle).
5. Substitutions: See Section 016000 - Product Requirements.

### B. Interior Hose Bibbs:

1. Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome plated where exposed with handwheel, integral vacuum breaker in compliance with ASSE 1011.

## 2.5 HYDRANTS

### A. Manufacturers:

1. Arrowhead Brass & Plumbing, LLC; [ ]: [www.arrowheadbrass.com/#sle](http://www.arrowheadbrass.com/#sle).
2. Jay R. Smith Manufacturing Company; [ ]: [www.jayrsmith.com/#sle](http://www.jayrsmith.com/#sle).
3. Zurn Industries, LLC; [ ]: [www.zurn.com/#sle](http://www.zurn.com/#sle).
4. Substitutions: See Section 016000 - Product Requirements.

### B. Wall Hydrants:

1. ASSE 1019; freeze resistant, self-draining type with chrome plated wall plate hose thread spout, handwheel, and integral vacuum breaker.

## 2.6 BACKFLOW PREVENTERS

### A. Manufacturers:

1. Watts Regulator Company, a part of Watts Water Technologies; [ ]: [www.wattsregulator.com/#sle](http://www.wattsregulator.com/#sle).
2. Zurn Industries, LLC; [ ]: [www.zurn.com/#sle](http://www.zurn.com/#sle).
3. Substitutions: See Section 016000 - Product Requirements.

### B. Reduced Pressure Backflow Preventers:

1. ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

## 2.7 WATER HAMMER ARRESTORS

### A. Manufacturers:

1. Jay R. Smith Manufacturing Company; [ ]: [www.jayrsmith.com/#sle](http://www.jayrsmith.com/#sle).
2. Watts Regulator Company, a part of Watts Water Technologies; [ ]: [www.wattsregulator.com/#sle](http://www.wattsregulator.com/#sle).
3. Zurn Industries, LLC; [ ]: [www.zurn.com/#sle](http://www.zurn.com/#sle).
4. Substitutions: See Section 016000 - Product Requirements.

### B. Water Hammer Arrestors:

1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F ( minus 73 to 149 degrees C ) and maximum 250 psi ( 1700 kPa ) working pressure.

## 2.8 RELIEF VALVES

### A. Manufacturers:

1. Cash Acme, a brand of Reliance Worldwide Corporation; [ ]: [www.cashacme.com/#sle](http://www.cashacme.com/#sle).
2. Substitutions: See Section 016000 - Product Requirements.

### B. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Install floor cleanouts at elevation to accommodate finished floor.

- E. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.
- F. Pipe relief from backflow preventer to nearest drain.
- G. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to lavatory sinks, washing machine outlets or [\_\_\_\_\_].
- H. Install air chambers on hot and cold water supply piping to each fixture or group of fixtures (each washroom). Fabricate same size as supply pipe or 3/4 inch ( 20 mm ) minimum, and minimum 18 inches ( 450 mm ) long.

END OF SECTION

## SECTION 223000 - PLUMBING EQUIPMENT

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Water Heaters:
  - 1. Commercial gas fired.
- B. In-line circulator pumps.
- C. Submersible sump pumps.

## 1.2 RELATED REQUIREMENTS

- A. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

## 1.3 REFERENCE STANDARDS

- A. ANSI Z21.10.1 - Gas Water Heaters - Volume I - Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less 2014.

## 1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittals procedures.
- B. Product Data:
  - 1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
  - 2. Indicate pump type, capacity, power requirements.
  - 3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
  - 4. Provide electrical characteristics and connection requirements.
- C. Manufacturer's start-up Instructions.
- D. Project Record Documents: Record actual locations of components.
- E. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.
- F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- G. Project Record Documents: Record actual locations of components.

## 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Certifications:
  - 1. Water Heaters: NSF approved.
  - 2. Gas Water Heaters: Certified by CSA International to ANSI Z21.10.1, as applicable, in addition to requirements specified elsewhere.
- C. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.
- D. Performance: Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

## 1.7 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.

- B. Provide five year manufacturer warranty for domestic water heaters.

## PART 2 PRODUCTS

### 2.1 WATER HEATERS

#### A. Manufacturers:

1. A.O. Smith Water Products Co; [ ]: [www.hotwater.com/#sle](http://www.hotwater.com/#sle).
2. Bock Water Heaters, Inc; [ ]: [www.bockwaterheaters.com/#sle](http://www.bockwaterheaters.com/#sle).
3. Rheem Manufacturing Company; [ ]: [www.rheem.com/#sle](http://www.rheem.com/#sle).
4. Substitutions: See Section 016000 - Product Requirements.

#### B. Commercial Gas Fired:

1. Type: Automatic, natural gas-fired, vertical storage.
2. Performance:
3. Tank: Glass lined welded steel; multiple flue passages, 4 inch ( 100 mm ) diameter inspection port, thermally insulated with minimum 2 inches ( 50 mm ) glass fiber, encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs.
4. Accessories:
  - a. Water Connections: Brass.
  - b. Dip Tube: Brass.
  - c. Drain valve.
  - d. Anode: Magnesium.
5. Certified For The Following Applications:

### 2.2 IN-LINE CIRCULATOR PUMPS

#### A. Manufacturers:

1. Armstrong Fluid Technology; [ ]: [www.armstrongfluidtechnology.com/#sle](http://www.armstrongfluidtechnology.com/#sle).
2. Bell & Gossett, a xylem brand; [ ]: [www.bellgossett.com/#sle](http://www.bellgossett.com/#sle).
3. Sterling SIHI GmbH; [ ]: [www.sterlingsihi.com/#sle](http://www.sterlingsihi.com/#sle).

- B. Casing: Bronze, rated for 125 psig ( 860 kPa ) working pressure, with stainless steel rotor assembly.

- C. Impeller: Bronze.

- D. Shaft: Alloy steel with integral thrust collar and two oil lubricated bronze sleeve bearings.

- E. Seal: Carbon rotating against a stationary ceramic seat.

- F. Drive: Flexible coupling.

### 2.3 SUBMERSIBLE SUMP PUMPS

#### A. Manufacturers:

1. Armstrong Fluid Technology; [ ]: [www.armstrongfluidtechnology.com/#sle](http://www.armstrongfluidtechnology.com/#sle).
2. Zoeller Company; [ ]: [www.zoeller.com/#sle](http://www.zoeller.com/#sle).
3. Stancor Pump & Controls: [www.stancorpumps.com](http://www.stancorpumps.com).
4. Substitutions: See Section 016000 - Product Requirements.

- B. Type: Completely submersible, vertical, centrifugal.

- C. Casing: Cast iron pump body and oil filled motor chamber.

- D. Impeller: Cast iron; open non-clog, stainless steel shaft.

- E. Bearings: Ball bearings.

- F. Accessories: Oil resistant 6 foot ( 2 m ) cord and plug with three-prong connector for connection to electric wiring system including grounding connector.

- G. Servicing: Slide-away coupling consisting of discharge elbow secure to sump floor, movable bracket, guide pipe system, lifting chain and chain hooks.

- H. Controls: Integral diaphragm type level controls with separate liquid level control high level alarm.
- I. Performance:
  - 1. Flow: 50 gpm ( [ ] L/s ), at 20 feet ( [ ] meters ) lift.
  - 2. Motor: [3/4] hp ( [ ] kW )

### PART 3 EXECUTION

#### 3.1 INSTALLATION

- A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.
- B. Coordinate with plumbing piping and related fuel piping work to achieve operating system.
- C. Pumps:
  - 1. Ensure shaft length allows sump pumps to be located minimum 24 inches ( 600 mm ) below lowest invert into sump pit and minimum 6 inches ( 150 mm ) clearance from bottom of sump pit.
  - 2. Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.
  - 3. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

END OF SECTION



## SECTION 224000 - PLUMBING FIXTURES

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Water closets.
- B. Urinals.
- C. Lavatories.
- D. Sinks.
- E. Mop sinks.
- F. Under-lavatory pipe supply covers.
- G. Electric water coolers.
- H. Drinking fountains.
- I. Showers.

## 1.2 RELATED REQUIREMENTS

- A. Section 221005 - Plumbing Piping.
- B. Section 221006 - Plumbing Piping Specialties.
- C. Section 223000 - Plumbing Equipment.

## 1.3 REFERENCE STANDARDS

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- B. ASME A112.18.9 - Protectors/Insulators for Exposed Waste and Supplies on Accessible Fixtures 2011 (Reaffirmed 2017).
- C. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping 2015.
- D. IAPMO Z124 - Plastic Plumbing Fixtures 2017.
- E. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration. 2013.
- F. ASME A112.18.1 - Plumbing Supply Fittings 2018.
- G. ASME A112.19.1 - Enamelled Cast Iron and Enamelled Steel Plumbing Fixtures 2018.
- H. ASME A112.19.2 - Ceramic Plumbing Fixtures 2018.
- I. ASME A112.19.3 - Stainless Steel Plumbing Fixtures 2017.
- J. ASSE 1014 - Performance Requirements for Backflow Prevention Devices for Hand-Held Showers 2005.
- K. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices 2015.
- L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.
- M. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- N. ISFA 2-01 - Classification and Standards for Solid Surfacing Material 2013.
- O. NEMA LD 3 - High-Pressure Decorative Laminates 2005.
- P. NSF 61 - Drinking Water System Components - Health Effects 2019.
- Q. NSF 372 - Drinking Water System Components - Lead Content 2016.
- R. UL (DIR) - Online Certifications Directory Current Edition.

## 1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- C. Manufacturer's Instructions: Indicate installation methods and procedures.
- D. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

- E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

## 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

## 1.6 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for electric water cooler.

## PART 2 PRODUCTS

### 2.1 GENERAL REQUIREMENTS

- A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.
- B. Water Efficiency: EPA WaterSense label is required for all water closets, urinals, lavatory faucets, and showerheads.

### 2.2 REGULATORY REQUIREMENTS

- A. Comply with applicable codes for installation of plumbing systems.
- B. Comply with UL (DIR) requirements.
- C. Perform work in accordance with local health department regulations.
- D. Provide certificate of compliance from Authority Having Jurisdiction indicating approval of installation.

### 2.3 FLUSH VALVE WATER CLOSETS

- A. Water Closets: Vitreous china, ASME A112.19.2, wall hung, siphon jet flush action, china bolt caps.
  - 1. Bowl: ASME A112.19.2; 16.5 inches ( 420 mm ) high with elongated rim. 1.28 GPF
  - 2. Flush Valve: Exposed (top spud). 1.28 GPF
  - 3. Flush Operation: Sensor operated.
  - 4. Handle Height: 44 inches ( 1117 mm ) or less.
  - 5. Color: White.
  - 6. Manufacturers:
    - a. American Standard, Inc; [ ]: [www.americanstandard-us.com/#sle](http://www.americanstandard-us.com/#sle).
    - b. Kohler Company; [ ]: [www.kohler.com/#sle](http://www.kohler.com/#sle).
    - c. Zurn Industries, Inc; [ ]: [www.zurn.com/#sle](http://www.zurn.com/#sle).
    - d. Substitutions: See Section 016000 - Product Requirements.
- B. Flush Valves: ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories.
  - 1. Sensor-Operated Type: Solenoid or motor-driven operator, battery powered, infrared sensor with mechanical over-ride or over-ride push button.
  - 2. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop. 1.28 GPF
  - 3. Manufacturers:
    - a. American Standard, Inc; [ ]: [www.americanstandard-us.com/#sle](http://www.americanstandard-us.com/#sle).
    - b. Sloan Valve Company; [ ]: [www.sloanvalve.com/#sle](http://www.sloanvalve.com/#sle).
    - c. Zurn Industries, Inc; [ ]: [www.zurn.com/#sle](http://www.zurn.com/#sle).
    - d. Substitutions: See Section 016000 - Product Requirements.
- C. Seats:
  - 1. Manufacturers:
    - a. American Standard, Inc; [ ]: [www.americanstandard-us.com/#sle](http://www.americanstandard-us.com/#sle).

- b. Bemis Manufacturing Company; [ ]: [www.bemismfg.com/#sle](http://www.bemismfg.com/#sle).
- c. Church Seat Company; [ ]: [www.churchseats.com/#sle](http://www.churchseats.com/#sle).
- d. Olsonite; [ ]: [www.olsonite.com/#sle](http://www.olsonite.com/#sle).
- e. Zurn Industries, Inc; [ ]: [www.zurn.com/#sle](http://www.zurn.com/#sle).
- f. Substitutions: See Section 016000 - Product Requirements.

## 2.4 WALL HUNG URINALS

### A. Wall Hung Urinal Manufacturers:

- 1. American Standard, Inc; [ ]: [www.americanstandard-us.com/#sle](http://www.americanstandard-us.com/#sle).
- 2. Kohler Company; [ ]: [www.kohler.com/#sle](http://www.kohler.com/#sle).
- 3. Zurn Industries, Inc; EcoVantage Z5798 High-Efficiency Urinal System: [www.zurn.com/#sle](http://www.zurn.com/#sle).
- 4. Substitutions: See Section 016000 - Product Requirements.

### B. Urinals: Vitreous china, ASME A112.19.2, wall hung with side shields and concealed carrier.

- 1. Flush Volume: 0.125 gallons ( 0.47 liters ), maximum.
- 2. Flush Valve: Exposed (top spud).
- 3. Flush Operation: Sensor operated.
- 4. Trap: Integral.

### C. Flush Valves: ASME A112.18.1, diaphragm type, complete with vacuum breaker stops and accessories.

- 1. Sensor-Operated Type: Solenoid or motor-driven operator, battery powered, infrared sensor with mechanical over-ride or over-ride push button.
- 2. Exposed Type: Chrome plated, escutcheon, integral screwdriver stop.
- 3. Manufacturers:
  - a. American Standard, Inc; [ ]: [www.americanstandard-us.com/#sle](http://www.americanstandard-us.com/#sle).
  - b. Sloan Valve Company; [ ]: [www.sloanvalve.com/#sle](http://www.sloanvalve.com/#sle).
  - c. Zurn Industries, Inc; [ ]: [www.zurn.com/#sle](http://www.zurn.com/#sle).
  - d. Substitutions: See Section 016000 - Product Requirements.

### D. Carriers:

- 1. Manufacturers:
  - a. Jay R. Smith MFG. Co; [ ]: [www.jrsmith.com/#sle](http://www.jrsmith.com/#sle).
  - b. JOSAM Company; [ ]: [www.josam.com/#sle](http://www.josam.com/#sle).
  - c. Zurn Industries, Inc; [ ]: [www.zurn.com/#sle](http://www.zurn.com/#sle).
  - d. Substitutions: See Section 016000 - Product Requirements.

## 2.5 LAVATORIES

### A. Lavatory Manufacturers:

- 1. American Standard, Inc; [ ]: [www.americanstandard-us.com/#sle](http://www.americanstandard-us.com/#sle).
- 2. Kohler Company; [ ]: [www.kohler.com/#sle](http://www.kohler.com/#sle).
- 3. Zurn Industries, Inc; [ ]: [www.zurn.com/#sle](http://www.zurn.com/#sle).
- 4. Substitutions: See Section 016000 - Product Requirements.

### B. Vitreous China Under-Mount Basin: ASME A112.19.2; vitreous china under-mount lavatory, front overflow, mounting kit and template by manufacturer.

### C. Supply Faucet Manufacturers:

- 1. American Standard, Inc; [ ]: [www.americanstandard-us.com/#sle](http://www.americanstandard-us.com/#sle).
- 2. Kohler Company; [ ]: [www.kohler.com/#sle](http://www.kohler.com/#sle).
- 3. Zurn Industries, Inc; [ ]: [www.zurn.com/#sle](http://www.zurn.com/#sle).
- 4. Substitutions: See Section 016000 - Product Requirements.

### D. Sensor Operated Faucet: Cast brass, chrome plated, deck mounted with sensor located on neck of spout.

1. Spout Style: Standard.
2. Power Supply: Battery, easily replaceable, alkaline or lithium, minimum 200,000 cycles.
3. Mixing Valve: External lever operated.
4. Water Supply: 3/8 inch ( 9 mm ) compression connections.
5. Aerator: Vandal resistant, 0.5 GPM ( 1.89 LPM ), laminar flow device.
6. Finish: Polished chrome.
7. Sensor Operated Faucet Manufacturers:
  - a. American Standard, Inc; [ ]: [www.americanstandard-us.com/#sle](http://www.americanstandard-us.com/#sle).
  - b. The Chicago Faucet Company; [ ]: [www.chicagofaucets.com/#sle](http://www.chicagofaucets.com/#sle).
  - c. Moen Incorporated; [ ]: [www.moen.com/#sle](http://www.moen.com/#sle).
  - d. Sloan Valve Company; [ ]: [www.sloanvalve.com/#sle](http://www.sloanvalve.com/#sle).
  - e. Toto USA; [ ]: [www.totousa.com/#sle](http://www.totousa.com/#sle).
  - f. Watts; [ ]: [www.watts.com/#sle](http://www.watts.com/#sle).
  - g. Zurn Industries, Inc; [ ]: [www.zurn.com/#sle](http://www.zurn.com/#sle).
  - h. Substitutions: See Section 016000 - Product Requirements.
- E. Thermostatic Mixing Valve: Thermostatic mixing valve, ASSE 1070 listed, with combination stop, strainer, and check valves, and flexible stainless steel connectors.
- F. Accessories:
  1. Chrome plated 17 gage, 0.0538 inch ( 1.37 mm ) brass P-trap with clean-out plug and arm with escutcheon.
  2. Offset waste with perforated open strainer.
  3. Rigid supplies.

## 2.6 SINKS

- A. Sink Manufacturers:
  1. American Standard, Inc; [ ]: [www.americanstandard-us.com/#sle](http://www.americanstandard-us.com/#sle).
  2. Kohler Company; [ ]: [www.kohler.com/#sle](http://www.kohler.com/#sle).
  3. Substitutions: See Section 016000 - Product Requirements.
- B. Single Compartment Bowl: ASME A112.19.3; [ ] by [ ] by [ ] inch ( [ ] by [ ] by [ ] mm ) outside dimensions 20 gage, 0.0359 inch ( 0.91 mm ) thick, Type 302 stainless steel, self rimming and undercoated, with ledge back drilled for trim.
  1. Drain: 1-1/2 inch ( 38 mm ) chromed brass drain.

## 2.7 UNDER-LAVATORY PIPE SUPPLY COVERS

- A. Basis of Design: Plumberex Specialty Products, Inc; [www.plumberex.com/#sle](http://www.plumberex.com/#sle).
  1. Under-Lavatory Covers with Snap-Lock Fasteners (Molded): Plumberex Pro-Extreme.
- B. General:
  1. Insulate exposed drainage piping including hot, cold and tempered water supplies under lavatories or sinks per ADA Standards.
  2. Construction: 1/8 inch ( 3.2 mm ) PVC with antimicrobial, antifungal and UV resistant properties.
    - a. Comply with ASTM C1822 Type III for covers on accessible lavatory piping.
    - b. Comply with ASME A112.18.9 for covers on accessible lavatory piping.
    - c. Comply with ICC A117.1.
  3. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces. No cable ties allowed.

## 2.8 SHOWER RECEPTORS

- A. Solid Surfacing Shower Receptors: Solid plastic resin casting, self-supporting, for installation over conventional subfloor; complying with ANSI Z124.1.2.
  - 1. Material: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, renewable material filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
  - 2. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 450 or less, Class A, when tested in accordance with ASTM E84.
  - 3. Finish on Exposed Surfaces: Provide satin or matte, gloss rating of 3 to 20.
- B. Drain Trim: Removable chrome plated strainer and tail piece.
- C. ADA Solid Surfacing Shower Receptors: Solid plastic resin casting, self-supporting, for installation over conventional subfloor; complying with ANSI Z124.1.2.
  - 1. Material: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, renewable material filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
  - 2. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 450 or less, Class A, when tested in accordance with ASTM E84.
  - 3. Finish on Exposed Surfaces: Provide satin or matte, gloss rating of 3 to 20.
- D. Drain Trim: Removable chrome plated strainer and tail piece.
- E. Terrazzo Shower Receptors: Terrazzo, self-supporting, for installation over conventional subfloor; complying with ANSI Z124.1.2.
  - 1. Material: Complying with ISFA 2-01 and NEMA LD 3; [\_\_\_\_], renewable material filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
  - 2. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 450 or less, Class A, when tested in accordance with ASTM E84.
  - 3. Finish on Exposed Surfaces: Provide satin or matte, gloss rating of 3 to 20.
- F. Drain Trim: Removable chrome plated strainer and tail piece.
- G. ADA Terrazzo Shower Receptors: Terrazzo, self-supporting, for installation over conventional subfloor; complying with ANSI Z124.1.2.
  - 1. Material: Complying with ISFA 2-01 and NEMA LD 3; [\_\_\_\_], renewable material filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
  - 2. Surface Burning Characteristics: Flame spread index of 25 or less, and smoke developed index of 450 or less, Class A, when tested in accordance with ASTM E84.
  - 3. Finish on Exposed Surfaces: Provide satin or matte, gloss rating of 3 to 20.

## 2.9 SHOWERS

- A. Shower Manufacturers:
  - 1. American Standard, Inc; [\_\_\_\_]: [www.americanstandard-us.com/#sle](http://www.americanstandard-us.com/#sle).
  - 2. Aqua Glass Corporation; [\_\_\_\_]: [www.aquaglass.com/#sle](http://www.aquaglass.com/#sle).

3. Best Bath Systems; [ ]: [www.bestbath.com/#sle](http://www.bestbath.com/#sle).
  4. Grohe America, Inc; [ ]: [www.grohe.com/us/#sle](http://www.grohe.com/us/#sle).
  5. Kohler Company; [ ]: [www.kohler.com/#sle](http://www.kohler.com/#sle).
  6. Substitutions: See Section 016000 - Product Requirements.
- B. Trim: ASME A112.18.1; concealed shower supply with indexed handles, bent shower arm with adjustable spray ball joint showerhead with maximum 1.5 gallons per minute ( 5.6 liters per minute ) flow, and escutcheon.
- C. Trim: ASME A112.18.1; concealed shower supply with pressure balanced mixing valves, integral service stops, bent shower arm with adjustable spray ball joint shower head with maximum flow, and escutcheon.
- D. -- To specify the shower and valve separately, use the paragraphs below. --
- E. Shower Valve:
1. Comply with ASME A112.18.1.
  2. Provide two handle in wall diverter valve body with integral thermostatic mixing valve to supply 1.5 gpm ( 0.094 L/s ).
- F. Shower Head:
1. ASME A112.18.1; chrome plated vandal-proof institutional head with integral wall bracket, built-in [1.5] gpm ( [ ] L/s ) flow control.
- G. Low-Flow Shower Head:
1. ASME A112.18.1; chrome plated vandal-proof institutional head with integral wall bracket, built-in 1.5 gpm ( 0.094 L/s ) flow control.
- H. Hand-Held Shower Head:
1. ASME A112.18.1, adjustable spray hand-held shower head with swivel fitting, with ASSE 1014 backflow preventer.
  2. Include 60 inch ( 1525 mm ) minimum flexible polished stainless steel hose and in-line vacuum breaker
  3. Provide 25 inch ( 635 mm ) grab bar with sliding spray holder that locks at any height, allowing use of unit as either a hand-held spray or a fixed shower head.
  4. Hand-Held Shower Head Manufacturers:
    - a. American Standard, Inc; [ ]: [www.americanstandard-us.com/#sle](http://www.americanstandard-us.com/#sle).
    - b. Grohe America, Inc; [ ]: [www.grohe.com/us/#sle](http://www.grohe.com/us/#sle).
    - c. Substitutions: See Section 016000 - Product Requirements.
- ## 2.10 BI-LEVEL, ELECTRIC WATER COOLERS
- A. Bi-level, Electric Water Cooler Manufacturers:
1. Elkay Manufacturing Company; [ ]: [www.elkay.com/#sle](http://www.elkay.com/#sle).
  2. Haws Corporation; [ ]: [www.hawscow.com/#sle](http://www.hawscow.com/#sle).
  3. Murdock Manufacturing, Inc; [ ]: [www.murdockmfg.com/#sle](http://www.murdockmfg.com/#sle).
  4. Oasis International; [ ]: [www.oasiscoolers.com/#sle](http://www.oasiscoolers.com/#sle).
  5. Substitutions: See Section 016000 - Product Requirements.
- B. Water Cooler: Bi-level, electric, mechanically refrigerated; surface mounted, ADA compliant; stainless steel top, vinyl on steel body, elevated anti-squirt bubbler with stream guard, automatic stream regulator, push button, mounting bracket; integral air cooled condenser and stainless steel grille.
1. Capacity: 8 gallons per hour ( 30.3 liters per hour ) of 50 degrees F ( 10 degrees C ) water with inlet at 80 degrees F ( 27 degrees C ) and room temperature of 90 degrees F ( 32 degrees C ), when tested in accordance with ASHRAE Std 18.

2. Electrical: 115 V, 60 Hertz compressor, 6 foot ( 2 m ) cord and plug for connection to electric wiring system including grounding connector.

C. Bottle Filler: Materials to match fountain.

## 2.11 MOP SINKS

A. Terrazzo Mop Sink Manufacturers:

1. Acorn Engineering Company; [ ]: [www.americanstandard-us.com/#sle](http://www.americanstandard-us.com/#sle).
2. Just Manufacturing Company; [ ]: [www.justmfg.com/#sle](http://www.justmfg.com/#sle).
3. Zurn Industries, Inc; [ ]: [www.zurn.com/#sle](http://www.zurn.com/#sle).
4. Substitutions: See Section 016000 - Product Requirements.

B. Material: Precast terrazzo composed of marble chips cast in Portland cement.

C. Tiling Flange Construction: Galvanized steel.

D. Grid strainer: Stainless steel; integral; removable.

E. Dimensions: As indicated on drawings.

F. Accessories:

1. [ ] feet ( [ ] m ) of 1/2 inch ( 13 mm ) diameter plain end reinforced plastic hose.
2. Hose clamp hanger.
3. Mop hanger.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- B. Verify that electric power is available and of the correct characteristics.
- C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

### 3.2 PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

### 3.3 INSTALLATION

- A. Install each fixture with trap, easily removable for servicing and cleaning.
- B. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.
- C. Install components level and plumb.
- D. Install and secure fixtures in place with wall supports and bolts.
- E. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

### 3.4 INTERFACE WITH WORK OF OTHER SECTIONS

- A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

### 3.5 ADJUSTING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

### 3.6 CLEANING

- A. Clean plumbing fixtures and equipment.

### 3.7 PROTECTION

- A. Protect installed products from damage due to subsequent construction operations.
- B. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

## SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Nameplates.
- B. Stencils.
- C. Ceiling tacks.

## 1.2 RELATED REQUIREMENTS

- A. Section 099123 - Interior Painting: Identification painting.

## 1.3 REFERENCE STANDARDS

- A. ASTM D709 - Standard Specification for Laminated Thermosetting Materials 2017.

## 1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturers catalog literature for each product required.

## PART 2 PRODUCTS

## 2.1 IDENTIFICATION APPLICATIONS

- A. Air Handling Units: Nameplates.
- B. Dampers: Ceiling tacks, where located above lay-in ceiling.
- C. Ductwork: Stencilled painting.
- D. Thermostats: Nameplates.

## 2.2 NAMEPLATES

- A. Manufacturers:
  - 1. Advanced Graphic Engraving, LLC:  
[www.advancedgraphicengraving.com/#sle](http://www.advancedgraphicengraving.com/#sle).
  - 2. Brimar Industries, Inc: [www.pipemarker.com/#sle](http://www.pipemarker.com/#sle).
  - 3. Craftmark Pipe Markers: [www.craftmarkid.com/#sle](http://www.craftmarkid.com/#sle).
  - 4. Kolbi Pipe Marker Co: [www.kolbipipemarkers.com/#sle](http://www.kolbipipemarkers.com/#sle).
  - 5. Seton Identification Products, a Tricor Direct Company: [www.seton.com/#sle](http://www.seton.com/#sle).
  - 6. [ ].
- B. Letter Color: White.
- C. Letter Height: 1/4 inch ( 6 mm ).
- D. Background Color: Black.
- E. Plastic: Comply with ASTM D709.

## 2.3 STENCILS

- A. Manufacturers:
  - 1. Brady Corporation: [www.bradycorp.com/#sle](http://www.bradycorp.com/#sle).
  - 2. Craftmark Pipe Markers: [www.craftmarkid.com/#sle](http://www.craftmarkid.com/#sle).
  - 3. Kolbi Pipe Marker Co: [www.kolbipipemarkers.com/#sle](http://www.kolbipipemarkers.com/#sle).
  - 4. Seton Identification Products, a Tricor Company: [www.seton.com/#sle](http://www.seton.com/#sle).
  - 5. Substitutions: See Section 016000 - Product Requirements.
- B. Stencils: With clean cut symbols and letters of following size:
  - 1. 3/4 to 1-1/4 inch ( 20-30 mm ) Outside Diameter of Insulation or Pipe: 8 inch ( 200 mm ) long color field, 1/2 inch ( 15 mm ) high letters.
  - 2. 1-1/2 to 2 inch ( 40-50 mm ) Outside Diameter of Insulation or Pipe: 8 inch ( 200 mm ) long color field, 3/4 inch ( 20 mm ) high letters.
  - 3. 2-1/2 to 6 inch ( 65-150 mm ) Outside Diameter of Insulation or Pipe: 12 inch ( 300 mm ) long color field, 1-1/4 inch ( 30 mm ) high letters.
  - 4. 8 to 10 inch ( 200-250 mm ) Outside Diameter of Insulation or Pipe: 24 inch ( 600 mm ) long color field, 2-1/2 inch ( 65 mm ) high letters.



5. Over 10 inch ( 250 mm ) Outside Diameter of Insulation or Pipe: 32 inch ( 800 mm ) long color field, 3-1/2 inch ( 90 mm ) high letters.
6. Ductwork and Equipment: 2-1/2 inch ( 65 mm ) high letters.
- C. Stencil Paint: As specified in Section 099123, semi-gloss enamel, colors complying with ASME A13.1.

#### 2.4 CEILING TACKS

- A. Description: Steel with 3/4 inch ( 20 mm ) diameter color coded head.
- B. Color code as follows:
  1. HVAC Equipment: Yellow.
  2. Fire Dampers and Smoke Dampers: Red.

### PART 3 EXECUTION

#### 3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Section 099123 for stencil painting.

#### 3.2 INSTALLATION

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Apply stencil painting in accordance with Section 099123.
- C. Install ductwork with stencilled painting. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.
- D. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

## SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Testing, adjustment, and balancing of air systems.
- B. Measurement of final operating condition of HVAC systems.
- C. Commissioning activities.

## 1.2 RELATED REQUIREMENTS

- A. Section 014000 - Quality Requirements: Employment of testing agency and payment for services.
- B. Section 019113 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.
- C. Section 230800 - Commissioning of HVAC.

## 1.3 REFERENCE STANDARDS

- A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition 2016.
- B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems 2008 (Reaffirmed 2017).
- C. NEBB (TAB) - Procedural Standards for Testing Adjusting and Balancing of Environmental Systems 2015, with Errata (2017).
- D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing 2002.

## 1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.
- C. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
  - 1. Submit under provisions of Section 014000.
  - 2. Submit to the the Commissioning Authority within two weeks after completion of testing, adjusting, and balancing.
  - 3. Revise TAB plan to reflect actual procedures and submit as part of final report.
  - 4. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
  - 5. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
  - 6. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
  - 7. Units of Measure: Report data in I-P (inch-pound) units only.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

## 3.1 GENERAL REQUIREMENTS

- A. Perform total system balance in accordance with one of the following:
  - 1. AABC (NSTSB), AABC National Standards for Total System Balance.
  - 2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
  - 3. SMACNA (TAB).

4. Maintain at least one copy of the standard to be used at project site at all times.
- B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
- C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.
- D. TAB Agency Qualifications:
  1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
  2. Having minimum of three years documented experience.
  3. Certified by one of the following:
    - a. AABC, Associated Air Balance Council: [www.aabc.com/#sle](http://www.aabc.com/#sle); upon completion submit AABC National Performance Guaranty.
    - b. NEBB, National Environmental Balancing Bureau: [www.nebb.org/#sle](http://www.nebb.org/#sle).
    - c. TABBB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: [www.tabbcertified.org/#sle](http://www.tabbcertified.org/#sle).
- E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

### 3.2 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
  1. Systems are started and operating in a safe and normal condition.
  2. Temperature control systems are installed complete and operable.
  3. Proper thermal overload protection is in place for electrical equipment.
  4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
  5. Duct systems are clean of debris.
  6. Fans are rotating correctly.
  7. Fire and volume dampers are in place and open.
  8. Air coil fins are cleaned and combed.
  9. Access doors are closed and duct end caps are in place.
  10. Air outlets are installed and connected.
  11. Duct system leakage is minimized.
- B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.
- C. Beginning of work means acceptance of existing conditions.

### 3.3 PREPARATION

- A. Hold a pre-balancing meeting at least one week prior to starting TAB work.
  1. Require attendance by all installers whose work will be tested, adjusted, or balanced.
- B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.
- C. Provide additional balancing devices as required.

### 3.4 ADJUSTMENT TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 10 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

- B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 10 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

### 3.5 RECORDING AND ADJUSTING

- A. Field Logs: Maintain written logs including:
  - 1. Running log of events and issues.
  - 2. Discrepancies, deficient or uncompleted work by others.
  - 3. Contract interpretation requests.
  - 4. Lists of completed tests.
- B. Ensure recorded data represents actual measured or observed conditions.
- C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- D. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.
- E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- G. Check and adjust systems approximately six months after final acceptance and submit report.

### 3.6 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- K. Where modulating dampers are provided, take measurements and balance at extreme conditions. [ ] .

### 3.7 COMMISSIONING

- A. See Sections 019113 - General Commissioning Requirements and 230800 for additional requirements.
- B. Perform prerequisites prior to starting commissioning activities.

- C. Fill out Prefunctional Checklists for:
  - 1. Air side systems.
- D. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.
- E. In the presence of the Commissioning Authority, verify that:
  - 1. Final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked.
  - 2. The air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints, and physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all terminal units taking off downstream of the static pressure sensor, the terminal unit on the critical leg has its damper 90 percent or more open.

### 3.8 SCOPE

- A. Test, adjust, and balance the following:
  - 1. Air Coils.
  - 2. Air Handling Units.
  - 3. Fans.
  - 4. Air Terminal Units.
  - 5. Air Inlets and Outlets.

### 3.9 MINIMUM DATA TO BE REPORTED

- A. Electric Motors:
  - 1. Manufacturer.
  - 2. Model/Frame.
  - 3. HP/BHP.
  - 4. Phase, voltage, amperage; nameplate, actual, no load.
  - 5. RPM.
  - 6. Service factor.
  - 7. Starter size, rating, heater elements.
  - 8. Sheave Make/Size/Bore.
- B. V-Belt Drives:
  - 1. Identification/location.
  - 2. Required driven RPM.
  - 3. Driven sheave, diameter and RPM.
  - 4. Belt, size and quantity.
  - 5. Motor sheave diameter and RPM.
  - 6. Center to center distance, maximum, minimum, and actual.
- C. Cooling Coils:
  - 1. Identification/number.
  - 2. Location.
  - 3. Service.
  - 4. Manufacturer.
  - 5. Air flow, design and actual.
  - 6. Entering air DB temperature, design and actual.
  - 7. Entering air WB temperature, design and actual.
  - 8. Leaving air DB temperature, design and actual.
  - 9. Leaving air WB temperature, design and actual.
- D. Heating Coils:

1. Identification/number.
  2. Location.
  3. Service.
  4. Manufacturer.
  5. Air flow, design and actual.
  6. Entering air temperature, design and actual.
  7. Leaving air temperature, design and actual.
  8. Air pressure drop, design and actual.
- E. Electric Duct Heaters:
1. Manufacturer.
  2. Identification/number.
  3. Location.
  4. Model number.
  5. Design kW.
  6. Number of stages.
  7. Phase, voltage, amperage.
  8. Test voltage (each phase).
  9. Test amperage (each phase).
  10. Air flow, specified and actual.
  11. Temperature rise, specified and actual.
- F. Air Moving Equipment:
1. Location.
  2. Manufacturer.
  3. Model number.
  4. Serial number.
  5. Arrangement/Class/Discharge.
  6. Air flow, specified and actual.
  7. Return air flow, specified and actual.
  8. Outside air flow, specified and actual.
  9. Total static pressure (total external), specified and actual.
  10. Inlet pressure.
  11. Discharge pressure.
  12. Sheave Make/Size/Bore.
  13. Number of Belts/Make/Size.
  14. Fan RPM.
- G. Return Air/Outside Air:
1. Identification/location.
  2. Design air flow.
  3. Actual air flow.
  4. Design return air flow.
  5. Actual return air flow.
  6. Design outside air flow.
  7. Actual outside air flow.
  8. Return air temperature.
  9. Outside air temperature.
  10. Required mixed air temperature.
  11. Actual mixed air temperature.
  12. Design outside/return air ratio.
  13. Actual outside/return air ratio.

## H. Exhaust Fans:

1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Air flow, specified and actual.
6. Total static pressure (total external), specified and actual.
7. Inlet pressure.
8. Discharge pressure.
9. Sheave Make/Size/Bore.
10. Number of Belts/Make/Size.
11. Fan RPM.

## I. Duct Traverses:

1. System zone/branch.
2. Duct size.
3. Area.
4. Design velocity.
5. Design air flow.
6. Test velocity.
7. Test air flow.
8. Duct static pressure.
9. Air temperature.
10. Air correction factor.

## J. Air Distribution Tests:

1. Air terminal number.
2. Room number/location.
3. Terminal type.
4. Terminal size.
5. Area factor.
6. Design velocity.
7. Design air flow.
8. Test (final) velocity.
9. Test (final) air flow.
10. Percent of design air flow.

END OF SECTION

## SECTION 230713 - DUCT INSULATION

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Duct insulation.
- B. Duct liner.

## 1.2 RELATED REQUIREMENTS

- A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section [\_\_\_\_\_]: Installation and finishing outdoor insulation jacket over roofing system.
- C. Section 230553 - Identification for HVAC Piping and Equipment.
- D. Section 233100 - HVAC Ducts and Casings: Glass fiber ducts.

## 1.3 REFERENCE STANDARDS

- A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus 2019.
- D. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2017.
- E. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications 2013 (Reapproved 2019).
- F. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation 2014 (Reapproved 2019).
- G. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation 2020.
- H. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material) 2019.
- I. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts 2016.
- J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.
- K. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.
- L. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015.
- M. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2005 (Revised 2009).
- N. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

## 1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

## 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.



## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

## 1.7 FIELD CONDITIONS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

## PART 2 PRODUCTS

### 2.1 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

### 2.2 GLASS FIBER, FLEXIBLE

- A. Manufacturer:
  - 1. CertainTeed Corporation: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
  - 2. Johns Manville: [www.jm.com/#sle](http://www.jm.com/#sle).
  - 3. JP Lamborn Co: [www.jpflex.com/#sle](http://www.jpflex.com/#sle).
  - 4. Knauf Insulation: [www.knaufinsulation.com/#sle](http://www.knaufinsulation.com/#sle).
  - 5. Owens Corning Corporation: [www.ocbuildingspec.com/#sle](http://www.ocbuildingspec.com/#sle).
  - 6. Substitutions: See Section 016000 - Product Requirements.
- B. Insulation: ASTM C553; flexible, noncombustible blanket.
  - 1. K ( Ksi ) value: 0.36 at 75 degrees F ( 0.052 at 24 degrees C ), when tested in accordance with ASTM C518.
  - 2. Maximum Service Temperature: 1200 degrees F ( 649 degrees C ).
  - 3. Maximum Water Vapor Absorption: 5.0 percent by weight.
- C. Vapor Barrier Jacket:
  - 1. Kraft paper with glass fiber yarn and bonded to aluminized film.
  - 2. Moisture Vapor Permeability: 0.02 perm inch ( 0.029 ng/Pa s m ), when tested in accordance with ASTM E96/E96M.
  - 3. Secure with pressure sensitive tape.
- D. Vapor Barrier Tape:
  - 1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- E. Tie Wire: Annealed steel, 16 gage, 0.0508 inch diameter ( 1.29 mm diameter ).

### 2.3 GLASS FIBER, RIGID

- A. Manufacturer:
  - 1. CertainTeed Corporation: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
  - 2. Johns Manville: [www.jm.com/#sle](http://www.jm.com/#sle).
  - 3. Knauf Insulation: [www.knaufinsulation.com/#sle](http://www.knaufinsulation.com/#sle).
  - 4. Owens Corning Corporation: [www.ocbuildingspec.com/#sle](http://www.ocbuildingspec.com/#sle).
  - 5. Substitutions: See Section 016000 - Product Requirements.
- B. Insulation: ASTM C612; rigid, noncombustible blanket.
  - 1. K ( Ksi ) Value: 0.24 at 75 degrees F ( 0.036 at 24 degrees C ), when tested in accordance with ASTM C518.
  - 2. Maximum Service Temperature: 450 degrees F ( 232 degrees C ).
  - 3. Maximum Water Vapor Absorption: 5.0 percent.
  - 4. Maximum Density: 8.0 lb/cu ft ( 128 kg/cu m ).
- C. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.
  2. Moisture Vapor Permeability: 0.02 perm inch ( 0.029 ng/Pa s m ), when tested in accordance with ASTM E96/E96M.
  3. Secure with pressure sensitive tape.
- D. Vapor Barrier Tape:
1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- E. Indoor Vapor Barrier Finish:
1. Cloth: Untreated; 9 oz/sq yd ( 305 g/sq m ) weight, glass fabric.
  2. Vinyl emulsion type acrylic, compatible with insulation, black color.
- 2.4 DUCT LINER
- A. Manufacturers:
1. Armacell LLC: [www.armacell.us/#sle](http://www.armacell.us/#sle).
  2. CertainTeed Corporation: [www.certainteed.com/#sle](http://www.certainteed.com/#sle).
  3. Ductmate Industries, Inc, a DMI Company: [www.ductmate.com/#sle](http://www.ductmate.com/#sle).
  4. Johns Manville: [www.jm.com/#sle](http://www.jm.com/#sle).
  5. Knauf Insulation: [www.knaufinsulation.com/#sle](http://www.knaufinsulation.com/#sle).
  6. Owens Corning Corporation: [www.ocbuildingspec.com/#sle](http://www.ocbuildingspec.com/#sle).
  7. Substitutions: See Section 016000 - Product Requirements.
- B. Glass Fiber Insulation: Non-corrosive, incombustible glass fiber complying with ASTM C1071; flexible blanket, rigid board and preformed round liner board; impregnated surface and edges coated with poly vinyl acetate polymer, acrylic polymer or black composite.
1. Fungal Resistance: No growth when tested according to ASTM G21.
  2. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F ( 0.045 at 24 degrees C ).
  3. Service Temperature: Up to 250 degrees F ( 121 degrees C ).
  4. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm ( 25.4 m/s ), minimum.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Test ductwork for design pressure prior to applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

#### 3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Insulated Ducts Conveying Air Below Ambient Temperature:
1. Provide insulation with vapor barrier jackets.
  2. Finish with tape and vapor barrier jacket.
  3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
  4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- D. Duct and Plenum Liner Application:
1. Adhere insulation with adhesive for 90 percent coverage.
  2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
  3. Seal and smooth joints. Seal and coat transverse joints.
  4. Seal liner surface penetrations with adhesive.

5. Duct dimensions indicated are net inside dimensions required for air-flow.  
Increase duct size to allow for insulation thickness.

### 3.3 SCHEDULES

- A. Exhaust Ducts Within 10 ft ( 3 m ) of Exterior Openings:
- B. Outside Air Intake ducts: Indoor installation minimum R-6 thermal resistance.  
Outdoor installation minimum R-8 thermal resistance.
- C. Plenums: Indoor installation minimum R-6 thermal resistance. Outdoor installation minimum R-8 thermal resistance.
- D. Supply ducts: Indoor installation minimum R-6 thermal resistance. Outdoor installation minimum R-8 thermal resistance.

END OF SECTION

## SECTION 230719 - HVAC PIPING INSULATION

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Piping insulation.
- B. Flexible removable and reusable blanket insulation.
- C. Jackets and accessories.

## 1.2 RELATED REQUIREMENTS

- A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 078400 - Firestopping.
- C. Section 232300 - Refrigerant Piping: Placement of inserts.

## 1.3 REFERENCE STANDARDS

- A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- B. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus 2019.
- D. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2017.
- E. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form 2016.
- F. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing 2010 (Reapproved 2016).
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.
- H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.
- I. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

## 1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

## 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

## 1.7 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

## PART 2 PRODUCTS

## 2.1 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

## 2.2 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturer:

1. Aeroflex USA, Inc: [www.aeroflexusa.com/#sle](http://www.aeroflexusa.com/#sle).
  2. Armacell LLC: [www.armacell.us/#sle](http://www.armacell.us/#sle).
  3. K-Flex USA LLC: [www.kflexusa.com/#sle](http://www.kflexusa.com/#sle).
  4. Substitutions: See Section 016000 - Product Requirements.
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
1. Minimum Service Temperature: Minus 40 degrees F ( Minus 40 degrees C ).
  2. Maximum Service Temperature: 180 degrees F ( 82 degrees C ).
  3. Connection: Waterproof vapor barrier adhesive.
- C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

## 2.3 JACKETS

- A. PVC Plastic.
1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
    - a. Minimum Service Temperature: 0 degrees F ( minus 18 degrees C ).
    - b. Maximum Service Temperature: 150 degrees F ( 66 degrees C ).
    - c. Moisture Vapor Permeability: 0.002 perm inch ( 0.0029 ng/Pa s m ), maximum, when tested in accordance with ASTM E96/E96M.
    - d. Thickness: 10 mil ( 0.25 mm ).
    - e. Connections: Brush on welding adhesive.
- B. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.
1. Thickness: 0.016 inch ( 0.40 mm ) sheet.
  2. Finish: Smooth.
  3. Joining: Longitudinal slip joints and 2 inch ( 50 mm ) laps.
  4. Fittings: 0.016 inch ( 0.4 mm ) thick die shaped fitting covers with factory attached protective liner.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

### 3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Exposed Piping: Locate insulation and cover seams in least visible locations.
- D. Insulated Pipes Conveying Fluids Below Ambient Temperature:
1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- E. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 078400.
- F. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with PVC or aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV resistant finish for flexible elastomeric cellular insulation without jacketing.

END OF SECTION

## SECTION 230800 - COMMISSIONING OF HVAC

## PART 1 GENERAL

## 1.1 SUMMARY

- A. See Section 019113 - General Commissioning Requirements for overall objectives; comply with the requirements of Section 019113.
- B. This section covers the Contractor's responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment item to be commissioned is responsible for the commissioning activities relating to that system or equipment item.
- C. The Commissioning Authority (CA) directs and coordinates all commissioning activities and provides Prefunctional Checklists and Functional Test Procedures for Contractor's use.
- D. The entire HVAC system is to be commissioned, including commissioning activities for the following specific items:
  - 1. Control system.
  - 2. Major and minor equipment items.
  - 3. Ductwork and accessories.
  - 4. Variable frequency drives.
  - 5. Other equipment and systems explicitly identified elsewhere in Contract Documents as requiring commissioning.
- E. The Prefunctional Checklist and Functional Test requirements specified in this section are in addition to, not a substitute for, inspection or testing specified in other sections.

## 1.2 RELATED REQUIREMENTS

- A. Section 019113 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.

## 1.3 REFERENCE STANDARDS

- A. ASHRAE Guideline 1.1 - The HVAC&R Technical Requirements for the Commissioning Process 2007, with Errata (2012).

## 1.4 SUBMITTALS

- A. Updated Submittals: Keep the Commissioning Authority informed of all changes to control system documentation made during programming and setup; revise and resubmit when substantial changes are made.
- B. Startup Reports, Prefunctional Checklists, and Trend Logs: Submit for approval of Commissioning Authority.
- C. HVAC Control System O&M Manual Requirements. In addition to documentation specified elsewhere, compile and organize at minimum the following data on the control system:
  - 1. Specific step-by-step instructions on how to perform and apply all functions, features, modes, etc. mentioned in the controls training sections of this specification and other features of this system. Provide an index and clear table of contents. Include the detailed technical manual for programming and customizing control loops and algorithms.
  - 2. Full as-built set of control drawings.
  - 3. Full as-built sequence of operations for each piece of equipment.
  - 4. Full points list; in addition to the information on the original points list submittal, include a listing of all rooms with the following information for each room:
    - a. Floor.
    - b. Room number.

- c. Room name.
  - d. Air handler unit ID.
  - e. Reference drawing number.
  - f. Air terminal unit tag ID.
  - g. Heating and/or cooling valve tag ID.
  - h. Minimum air flow rate.
  - i. Maximum air flow rate.
5. Full print out of all schedules and set points after testing and acceptance of the system.
  6. Electronic copy on disk of the entire program for this facility.
  7. Marking of all system sensors and thermostats on the as-built floor plan and HVAC drawings with their control system designations.
  8. Maintenance instructions, including sensor calibration requirements and methods by sensor type, etc.
  9. Control equipment component submittals, parts lists, etc.
  10. Warranty requirements.
  11. Copies of all checkout tests and calibrations performed by the Contractor (not commissioning tests).
  12. Organize and subdivide the manual with permanently labeled tabs for each of the following data in the given order:
    - a. Sequences of operation.
    - b. Control drawings.
    - c. Points lists.
    - d. Controller and/or module data.
    - e. Thermostats and timers.
    - f. Sensors and DP switches.
    - g. Valves and valve actuators.
    - h. Dampers and damper actuators.
    - i. Program setups (software program printouts).
- D. Project Record Documents: See Section 017800 for additional requirements.
1. Submit updated version of control system documentation, for inclusion with operation and maintenance data.
  2. Show actual locations of all static and differential pressure sensors (air, water and building pressure) and air-flow stations on project record drawings.
- E. Training Manuals: See Section 017900 for additional requirements.
1. Provide three extra copies of the controls training manuals in a separate manual from the O&M manuals.

## PART 2 PRODUCTS

### 2.1 TEST EQUIPMENT

- A. Provide all standard testing equipment required to perform startup and initial checkout and required functional performance testing; unless otherwise noted such testing equipment will NOT become the property of Owner.
- B. Equipment-Specific Tools: Where special testing equipment, tools and instruments are specific to a piece of equipment, are only available from the vendor, and are required in order to accomplish startup or Functional Testing, provide such equipment, tools, and instruments as part of the work at no extra cost to Owner; such equipment, tools, and instruments are to become the property of Owner.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Cooperate with the Commissioning Authority in development of the Prefunctional Checklists and Functional Test Procedures.
- B. Furnish additional information requested by the Commissioning Authority.
- C. Prepare a preliminary schedule for HVAC pipe and duct system testing, flushing and cleaning, equipment start-up and testing, adjusting, and balancing start and completion for use by the Commissioning Authority; update the schedule as appropriate.
- D. Notify the Commissioning Authority when pipe and duct system testing, flushing, cleaning, startup of each piece of equipment and testing, adjusting, and balancing will occur; when commissioning activities not yet performed or not yet scheduled will delay construction notify ahead of time and be proactive in seeing that the Commissioning Authority has the scheduling information needed to efficiently execute the commissioning process.
- E. Put all HVAC equipment and systems into operation and continue operation during each working day of testing, adjusting, and balancing and commissioning, as required.
- F. Provide test holes in ducts and plenums where directed to allow air measurements and air balancing; close with an approved plug.

### 3.2 INSPECTING AND TESTING - GENERAL

- A. Submit startup plans, startup reports, and Prefunctional Checklists for each item of equipment or other assembly to be commissioned.
- B. Perform the Functional Tests directed by the Commissioning Authority for each item of equipment or other assembly to be commissioned.
- C. Provide two-way radios for use during the testing.
- D. Valve/Damper Stroke Setup and Check:
  - 1. For all valve/damper actuator positions checked, verify the actual position against the control system readout.
  - 2. Set pump/fan to normal operating mode.
  - 3. Command valve/damper closed; visually verify that valve/damper is closed and adjust output zero signal as required.
  - 4. Command valve/damper open; verify position is full open and adjust output signal as required.
  - 5. Command valve/damper to a few intermediate positions.
  - 6. If actual valve/damper position does not reasonably correspond, replace actuator or add pilot positioner (for pneumatics).
- E. Deficiencies: Correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.

### 3.3 TAB COORDINATION

- A. TAB: Testing, adjusting, and balancing of HVAC.
- B. Coordinate commissioning schedule with TAB schedule.
- C. Review the TAB plan to determine the capabilities of the control system toward completing TAB.
- D. Provide all necessary unique instruments and instruct the TAB technicians in their use; such as handheld control system interface for setting terminal unit boxes, etc.
- E. Have all required Prefunctional Checklists, calibrations, startup and component Functional Tests of the system completed and approved by the Commissioning Authority prior to starting TAB.



- F. Provide a qualified control system technician to operate the controls to assist the TAB technicians or provide sufficient training for the TAB technicians to operate the system without assistance.

### 3.4 CONTROL SYSTEM FUNCTIONAL TESTING

- A. Prefunctional Checklists for control system components will require a signed and dated certification that all system programming is complete as required to accomplish the requirements of Contract Documents and the detailed Sequences of Operation documentation submittal.
- B. Do not start Functional Testing until all controlled components have themselves been successfully Functionally Tested in accordance with Contract Documents.
- C. Using a skilled technician who is familiar with this building, execute the Functional Testing of the control system as required by the Commissioning Authority.
- D. Functional Testing of the control system constitutes demonstration and trend logging of control points monitored by the control system.
  - 1. The scope of trend logging is partially specified; trend log up to 50 percent more points than specified at no extra cost to Owner.
  - 2. Perform all trend logging specified in Prefunctional Checklists and Functional Test procedures.
- E. Functionally Test integral or stand-alone controls in conjunction with the Functional Tests of the equipment they are attached to, including any interlocks with other equipment or systems; further testing during control system Functional Test is not required unless specifically indicated below.
- F. Demonstrate the following to the Commissioning Authority during testing of controlled equipment; coordinate with commissioning of equipment.
  - 1. Setpoint changing features and functions.
  - 2. Sensor calibrations.
- G. Demonstrate to the Commissioning Authority:
  - 1. That all specified functions and features are set up, debugged and fully operable.
  - 2. That scheduling features are fully functional and setup, including holidays.
  - 3. That all graphic screens and value readouts are completed.
  - 4. Correct date and time setting in central computer.
  - 5. That field panels read the same time as the central computer; sample 10 percent of field panels; if any of those fail, sample another 10 percent; if any of those fail test all remaining units at no extra cost to Owner.
  - 6. Functionality of field panels using local operator keypads and local ports (plug-ins) using portable computer/keypad; demonstrate 100 percent of panels and 10 percent of ports; if any ports fail, sample another 10 percent; if any of those fail, test all remaining units at no extra cost to Owner.
  - 7. Power failure and battery backup and power-up restart functions.
  - 8. Global commands features.
  - 9. Security and access codes.
  - 10. Occupant over-rides (manual, telephone, key, keypad, etc.).
  - 11. O&M schedules and alarms.
  - 12. Occupancy sensors and controls.
  - 13. Fire alarm interlocks and response.
  - 14. All control strategies and sequences not tested during controlled equipment testing.

- H. If the control system, integral control components, or related equipment do not respond to changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice, under any of the conditions, sequences, or modes tested, correct all systems, equipment, components, and software required at no additional cost to Owner.

### 3.5 OPERATION AND MAINTENANCE MANUALS

- A. See Section 017800 for additional requirements.
- B. Add design intent documentation furnished by Architect to manuals prior to submission to Owner.
- C. Submit manuals related to items that were commissioned to Commissioning Authority for review; make changes recommended by Commissioning Authority.
- D. Commissioning Authority will add commissioning records to manuals after submission to Owner.

### 3.6 DEMONSTRATION AND TRAINING

- A. See Section 017900 for additional requirements.
- B. Demonstrate operation and maintenance of HVAC system to Owner' personnel; if during any demonstration, the system fails to perform in accordance with the information included in the O&M manual, stop demonstration, repair or adjust, and repeat demonstration. Demonstrations may be combined with training sessions if appropriate.
- C. These demonstrations are in addition to, and not a substitute for, Prefunctional Checklists and demonstrations to the Commissioning Authority during Functional Testing.
- D. Provide classroom and hands-on training of Owner's designated personnel on operation and maintenance of the HVAC system, control system, and all equipment items indicated to be commissioned. Provide the following minimum durations of training:
- E. TAB Review: Instruct Owner's personnel for minimum [ ] hours, after completion of TAB, on the following:
  - 1. Review final TAB report, explaining the layout and meanings of each data type.
  - 2. Discuss any outstanding deficient items in control, ducting or design that may affect the proper delivery of air or water.
  - 3. Identify and discuss any terminal units, duct runs, diffusers, coils, fans and pumps that are close to or are not meeting their design capacity.
  - 4. Discuss any temporary settings and steps to finalize them for any areas that are not finished.
  - 5. Other salient information that may be useful for facility operations, relative to TAB.
- F. Provide the services of manufacturer representatives to assist instructors where necessary.
- G. Provide the services of the HVAC controls instructor at other training sessions, when requested, to discuss the interaction of the controls system as it relates to the equipment being discussed.

END OF SECTION

## SECTION 233100 - HVAC DUCTS AND CASINGS

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Metal ductwork.
- B. Casing and plenums.
- C. Duct cleaning.

## 1.2 RELATED REQUIREMENTS

- A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 078400 - Firestopping.
- C. Section 230593 - Testing, Adjusting, and Balancing for HVAC.
- D. Section 230713 - Duct Insulation: External insulation and duct liner.
- E. Section 233300 - Air Duct Accessories.
- F. Section 233700 - Air Outlets and Inlets.

## 1.3 REFERENCE STANDARDS

- A. ASHRAE (FUND) - ASHRAE Handbook - Fundamentals Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2014.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2019a.
- D. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable 2018.
- E. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.
- F. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- G. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.
- I. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements 2015.
- J. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements 2015.
- K. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements 2015.
- L. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements 2016.
- M. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2018.
- N. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2005 (Revised 2009).
- O. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors current edition, including all revisions.

## 1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for duct materials.

- C. Shop Drawings: Indicate duct fittings, particulars such as gages, sizes, welds, and configurations prior to start of work. Shop drawings shall coordinate duct routing with all above ceiling trades.
- D. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

#### 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.
- B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum [ ] years of documented experience.

#### 1.6 FIELD CONDITIONS

- A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures within acceptable range during and after installation of duct sealants.

### PART 2 PRODUCTS

#### 2.1 DUCT ASSEMBLIES

- A. Regulatory Requirements: Construct ductwork to comply with NFPA 90A standards.
- B. Ducts: Galvanized steel, unless otherwise indicated.
- C. Low Pressure Supply (Heating Systems): 1/2 inch w.g. ( 125 Pa ) pressure class, galvanized steel.
- D. Low Pressure Supply (System with Cooling Coils): 1/2 inch w.g. ( 125 Pa ) pressure class, galvanized steel.
- E. Medium Pressure Supply: 3 inch w.g. ( 746 Pa ) pressure class, galvanized steel.
- F. Return and Relief: 1/2 inch w.g. ( 125 Pa ) pressure class, galvanized steel.
- G. General Exhaust: 1/2 inch w.g. ( 125 Pa ) pressure class, galvanized steel unless noted as aluminum on plans.
- H. Outside Air Intake: 1/2 inch w.g. ( 125 Pa ) pressure class, galvanized steel.

#### 2.2 MATERIALS

- A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.
- B. Aluminum for Ducts: ASTM B209 (ASTM B209M); aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061-T651 or of equivalent strength.
- C. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
  - 1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
  - 2. VOC Content: Not more than 250 g/L, excluding water.
  - 3. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
  - 4. For Use With Flexible Ducts: UL labeled.
- D. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.
- E. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:

1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
2. Masonry Wedge Expansion Anchors: Complying with ICC-ES AC01.
3. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
4. Masonry Screw Type Anchors: Complying with ICC-ES AC106.
5. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.
6. Other Types: As required.

### 2.3 DUCTWORK FABRICATION

- A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.
- B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.
- D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- E. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).
- F. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

### 2.4 MANUFACTURED DUCTWORK AND FITTINGS

- A. Spiral Ducts: Round spiral lockseam duct with galvanized steel outer wall.
  1. Manufacture in accordance with SMACNA (DCS).
- B. Flexible Ducts: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound spring steel wire.
  1. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
  2. Pressure Rating: 10 inches WG ( 2.50 kPa ) positive and 1.0 inches WG ( 250 Pa ) negative.
  3. Maximum Velocity: 4000 fpm ( 20.3 m/sec ).
  4. Temperature Range: Minus 20 degrees F to 210 degrees F ( Minus 28 degrees C to 99 degrees C ).

### 2.5 CASINGS

- A. Fabricate casings in accordance with SMACNA (DCS) and construct for operating pressures indicated.
- B. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install, support, and seal ducts in accordance with SMACNA (DCS).
- B. Install in accordance with manufacturer's instructions.
- C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- D. Flexible Ducts: Connect to metal ducts with adhesive.
- E. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.
- F. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems,

complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

- G. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- H. Use crimp joints with or without bead for joining round duct sizes 8 inch ( 200 mm ) and smaller with crimp in direction of air flow.
- I. Use double nuts and lock washers on threaded rod supports.
- J. Connect terminal units to supply ducts directly or with one foot ( 300 mm ) maximum length of flexible duct. Do not use flexible duct to change direction.
- K. Connect diffusers to low pressure ducts with 8ft maximum length of flexible duct held in place with strap or clamp. Where diffuser is in exposed ceiling use as little flex duct as possible.

### 3.2 CLEANING

- A. See Section 017419 - Construction Waste Management and Disposal, for additional requirements.
- B. Clean duct systems with high power vacuum machines. Protect equipment that could be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

END OF SECTION

## SECTION 233300 - AIR DUCT ACCESSORIES

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Air turning devices/extractors.
- B. Backdraft dampers - metal.
- C. Backdraft dampers - fabric.
- D. Duct access doors.
- E. Duct test holes.
- F. Flexible duct connectors.
- G. Volume control dampers.
- H. Miscellaneous products:
  - 1. Duct opening closure film.

## 1.2 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.
- B. Section 233100 - HVAC Ducts and Casings.
- C. Section 253523 - Integrated Automation Control Dampers: Product furnishing.

## 1.3 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.
- B. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2018.
- C. NFPA 92 - Standard for Smoke Control Systems 2018.
- D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2005 (Revised 2009).
- E. UL 33 - Safety Heat Responsive Links for Fire-Protection Service Current Edition, Including All Revisions.
- F. UL 555 - Standard for Fire Dampers Current Edition, Including All Revisions.
- G. UL 555S - Standard for Smoke Dampers Current Edition, Including All Revisions.

## 1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.
- C. Project Record Drawings: Record actual locations of access doors and test holes.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Fusible Links: One of each type and size.

## 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect dampers from damage to operating linkages and blades.

## PART 2 PRODUCTS

## 2.1 AIR TURNING DEVICES/EXTRACTORS

- A. Manufacturers:
  - 1. Carlisle HVAC Products: [www.carlislehvac.com/#sle](http://www.carlislehvac.com/#sle).

2. Elgen Manufacturing, Inc: [www.elgenmfg.com/#sle](http://www.elgenmfg.com/#sle).
  3. Krueger-HVAC, Division of Air System Components: [www.krueger-hvac.com/#sle](http://www.krueger-hvac.com/#sle).
  4. Ruskin Company: [www.ruskin.com/#sle](http://www.ruskin.com/#sle).
  5. Titus HVAC, a brand of Johnson Controls: [www.titus-hvac.com/#sle](http://www.titus-hvac.com/#sle).
  6. Ward Industries, a brand of Hart and Cooley, Inc: [www.wardind.com/#sle](http://www.wardind.com/#sle).
  7. Substitutions: See Section 016000 - Product Requirements.
- B. Multi-blade device with blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps.
- 2.2 BACKDRAFT DAMPERS - METAL
- A. Manufacturers:
1. Louvers & Dampers, Inc, a brand of Mestek, Inc: [www.louvers-dampers.com/#sle](http://www.louvers-dampers.com/#sle).
  2. Nailor Industries, Inc: [www.nailor.com/#sle](http://www.nailor.com/#sle).
  3. Ruskin Company: [www.ruskin.com/#sle](http://www.ruskin.com/#sle).
  4. United Enertech: [www.unitedenertech.com/#sle](http://www.unitedenertech.com/#sle).
  5. Substitutions: See Section 016000 - Product Requirements.
- B. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch ( 150 mm ) width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.
- 2.3 BACKDRAFT DAMPERS - FABRIC
- A. Fabric Backdraft Dampers: Factory-fabricated.
1. Blades: Neoprene coated fabric material.
  2. Birdscreen: 1/2 inch ( 12 mm ) nominal mesh of galvanized steel or aluminum.
  3. Maximum Velocity: 1000 fpm (5 mps) face velocity.
- 2.4 COMBINATION FIRE AND SMOKE DAMPERS
- A. Products furnished per Section 253523.
- B. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.
- C. Provide factory sleeve and collar for each damper.
- D. Operators: UL listed and labelled spring return electric type suitable for 120 volts, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on interior of duct and link to damper operating shaft.
- 2.5 DUCT ACCESS DOORS
- A. Manufacturers:
1. Acudor Products Inc, a Division of Nelson Industrial Inc: [www.acudor.com/#sle](http://www.acudor.com/#sle).
  2. Ductmate Industries, Inc, a DMI Company: [www.ductmate.com/#sle](http://www.ductmate.com/#sle).
  3. Elgen Manufacturing, Inc: [www.elgenmfg.com/#sle](http://www.elgenmfg.com/#sle).
  4. Lloyd Industries, Inc: [www.firedamper.com/#sle](http://www.firedamper.com/#sle).
  5. MKT Metal Manufacturing: [www.mktduct.com/#sle](http://www.mktduct.com/#sle).
  6. Nailor Industries, Inc: [www.nailor.com/#sle](http://www.nailor.com/#sle).
  7. Ruskin Company: [www.ruskin.com/#sle](http://www.ruskin.com/#sle).
  8. SEMCO LLC: [www.semcohvac.com/#sle](http://www.semcohvac.com/#sle).
  9. Ward Industries, a brand of Hart and Cooley, Inc: [www.wardind.com/#sle](http://www.wardind.com/#sle).
  10. Substitutions: See Section 016000 - Product Requirements.
- B. Fabricate in accordance with SMACNA (DCS) and as indicated.



## 2.6 DUCT TEST HOLES

- A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.
- B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

## 2.7 FLEXIBLE DUCT CONNECTORS

- A. Manufacturers:
  - 1. Carlisle HVAC Products: [www.carlislehvac.com/#sle](http://www.carlislehvac.com/#sle).
  - 2. Ductmate Industries, Inc, a DMI Company: [www.ductmate.com/#sle](http://www.ductmate.com/#sle).
  - 3. Elgen Manufacturing, Inc: [www.elgenmfg.com/#sle](http://www.elgenmfg.com/#sle).
  - 4. Substitutions: See Section 016000 - Product Requirements.
- B. Fabricate in accordance with SMACNA (DCS) and as indicated.
- C. Flexible Duct Connections: Fabric crimped into metal edging strip.
  - 1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd ( 1.0 kg/sq m ).
  - 2. Metal: 3 inches ( 75 mm ) wide, 24 gage, 0.0239 inch ( 0.61 mm ) thick galvanized steel.
- D. Maximum Installed Length: 14 inch ( 356 mm ).

## 2.8 VOLUME CONTROL DAMPERS

- A. Products furnished per Section 253523.
- B. Fabricate in accordance with SMACNA (DCS) and as indicated.
- C. Splitter Dampers:
  - 1. Material: Same gage as duct to 24 inches ( 600 mm ) size in either direction, and two gages heavier for sizes over 24 inches ( 600 mm ).
  - 2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.
  - 3. Operator: Minimum 1/4 inch ( 6 mm ) diameter rod in self aligning, universal joint action, flanged bushing with set screw .
- D. Single Blade Dampers:
  - 1. Fabricate for duct sizes up to 6 by 30 inch ( 150 by 760 mm ).
  - 2. Blade: 24 gage, 0.0239 inch ( 0.61 mm ), minimum.
- E. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 by 72 inch ( 200 by 1825 mm ). Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
  - 1. Blade: 18 gage, 0.0478 inch ( 1.21 mm ), minimum.
- F. End Bearings: Except in round ducts 12 inches ( 300 mm ) and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.
- G. Quadrants:
  - 1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
  - 2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.
  - 3. Where rod lengths exceed 30 inches ( 750 mm ) provide regulator at both ends.

## 2.9 MISCELLANEOUS PRODUCTS

- A. Duct Opening Closure Film: Mold-resistant, self-adhesive film to keep debris out of ducts during construction.
  - 1. Thickness: 2 mils ( 0.6 mm ).

2. High tack water based adhesive.
3. UV stable light blue color.
4. Elongation Before Break: 325 percent, minimum.

### PART 3 EXECUTION

#### 3.1 PREPARATION

- A. Verify that electric power is available and of the correct characteristics.

#### 3.2 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 233100 for duct construction and pressure class.
- B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide minimum 8 by 8 inch ( 200 by 200 mm ) size for hand access, size for shoulder access, and as indicated. Provide 4 by 4 inch ( 100 by 100 mm ) for balancing dampers only. Review locations prior to fabrication.
- D. Provide duct test holes where indicated and required for testing and balancing purposes.
- E. Provide fire dampers, combination fire and smoke dampers and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by Authorities Having Jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
- F. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.
- G. Demonstrate re-setting of fire dampers to Owner's representative.
- H. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.
- I. Use splitter dampers only where indicated.
- J. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

## SECTION 233423 - HVAC POWER VENTILATORS

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Cabinet exhaust fans.
- B. Inline centrifugal fans.

## 1.2 RELATED REQUIREMENTS

- A. Section 233300 - Air Duct Accessories: Backdraft dampers.

## 1.3 REFERENCE STANDARDS

- A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program 2015.
- B. AMCA 99 - Standards Handbook 2016.
- C. AMCA 204 - Balance Quality and Vibration Levels for Fans 2005 (Reaffirmed 2012).
- D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating 2016.
- E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans 2014.
- F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data 2014.
- G. NEMA MG 1 - Motors and Generators 2018.
- H. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2018.
- I. UL 705 - Power Ventilators Current Edition, Including All Revisions.

## 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

## 1.5 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.
- C. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

## 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

## 1.7 FIELD CONDITIONS

- A. Permanent ventilators may be used for ventilation during construction only after ductwork is clean, filters are in place, bearings have been lubricated, and fan has been test run under observation.

## PART 2 PRODUCTS

## 2.1 MANUFACTURERS

- A. Greenheck Fan Corporation: [www.greenheck.com/#sle](http://www.greenheck.com/#sle).
- B. Loren Cook Company: [www.lorencook.com/#sle](http://www.lorencook.com/#sle).
- C. PennBarry, Division of Air System Components: [www.pennbarry.com/#sle](http://www.pennbarry.com/#sle).
- D. Twin City Fan & Blower: [www.tcf.com/#sle](http://www.tcf.com/#sle).
- E. Tjernlund

## 2.2 POWER VENTILATORS - GENERAL

- A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.

- B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.
- C. Sound Ratings: AMCA 301, tested to AMCA 300 and bearing AMCA Certified Sound Rating Seal.
- D. Fabrication: Comply with AMCA 99.
- E. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.
- F. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- G. Enclosed Safety Switches: Comply with NEMA 250.

## 2.3 CABINET EXHAUST FANS

- A. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.
- B. Disconnect Switch: Cord and plug in housing for thermal overload protected motor.
- C. Grille: Molded white plastic.
- D. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

## 2.4 INLINE CENTRIFUGAL FANS

- A. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing [\_\_\_\_], resilient mounted motor, gravity backdraft damper in discharge.
- B. Disconnect Switch: Cord and plug in housing for thermal overload protected motor.
- C. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

# PART 3 EXECUTION

## 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure roof exhausters with cadmium plated steel lag screws to roof curb.
- C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.
- D. Provide sheaves required for final air balance.
- E. Install backdraft dampers on inlet to roof and wall exhausters.
- F. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

END OF SECTION

## SECTION 233700 - AIR OUTLETS AND INLETS

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Diffusers.
- B. Registers/grilles.
- C. Louvers.

## 1.2 RELATED REQUIREMENTS

- A. Section 099123 - Interior Painting: Painting of ducts visible behind outlets and inlets.

## 1.3 REFERENCE STANDARDS

- A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating 2015.
- B. AMCA 511 - Certified Ratings Program for Air Control Devices 2010.
- C. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Inlets 2006 (Reaffirmed 2011).
- D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2014.
- E. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2013.
- F. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.
- G. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2005 (Revised 2009).

## 1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

## 1.5 QUALITY ASSURANCE

- A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.
- B. Test and rate louver performance in accordance with AMCA 500-L.

## PART 2 PRODUCTS

## 2.1 MANUFACTURERS

- A. Hart & Cooley, Inc: [www.hartandcooley.com/#sle](http://www.hartandcooley.com/#sle).
- B. Krueger-HVAC, Division of Air System Components: [www.krueger-hvac.com/#sle](http://www.krueger-hvac.com/#sle).
- C. Metalaire, a brand of Metal Industries Inc: [www.metalaire.com/#sle](http://www.metalaire.com/#sle).
- D. Price Industries: [www.price-hvac.com/#sle](http://www.price-hvac.com/#sle).
- E. Titus, a brand of Air Distribution Technologies: [www.titus-hvac.com/#sle](http://www.titus-hvac.com/#sle).
- F. Tuttle and Bailey: [www.tuttleandbailey.com/#sle](http://www.tuttleandbailey.com/#sle).
- G. United Enertech: [www.unitedenertech.com](http://www.unitedenertech.com)
- H. Arrow: [www.arrowunited.com](http://www.arrowunited.com)
- I. Ruskin: [www.ruskin.com](http://www.ruskin.com)
- J. Substitutions: See Section 016000 - Product Requirements.

## 2.2 SQUARE CEILING DIFFUSERS

- A. Type: Provide square, steel, plaqued face diffuser to discharge air in 360 degree, one way, two way, three way and four way pattern with sectorizing baffles where indicated.
- B. Connections: Round.
- C. Frame: Contractor shall coordinate frame type with the Architectural Reflected Ceiling plans.

- D. Construction: Made of steel with factory enamel finish.
- E. Color: To be selected by Architect from manufacturer's standard range.
- F. Accessories: Provide radial opposed blade volume control damper.

## 2.3 CEILING SUPPLY REGISTERS/GRILLES

- A. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille, two-way deflection. Refer to equipment schedule for blade spacing and orientation.
- B. Frame: Contractor shall coordinate frame type with the Architectural Reflected Ceiling plans.
- C. Fabrication: Aluminum extrusions with factory baked enamel finish.
- D. Color: As selected by Architect from manufacturer's standard range.
- E. Damper: Integral, gang-operated, opposed blade type, operable from face.

## 2.4 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

- A. Type: Streamlined blades with blades set at 45 degrees. Blade spacing and orientation per the equipment schedule.
- B. Frame: Contractor shall coordinate frame type with the Architectural Reflected Ceiling plans.
- C. Construction: Made of aluminum extrusions with factory enamel finish.
- D. Color: To be selected by Architect from manufacturer's standard range.
- E. Damper: For exhaust applications only, provide integral, gang-operated, opposed blade type, operable from face.

## 2.5 CEILING EGG CRATE EXHAUST AND RETURN GRILLES

- A. Type: Egg crate style face consisting of 1/2 by 1/2 by 1/2 inch, 1/2 by 1/2 by 1 inch, and 1 by 1 by 1 inch grid core.
- B. Fabrication: Grid core consists of aluminum with baked enamel finish.
- C. Color: To be selected by Architect from manufacturer's standard range.
- D. Frame: Contractor shall coordinate frame type with the Architectural Reflected Ceiling plans.
- E. Accessories: Provide opposed blade damper in exhaust applications.

## 2.6 WALL SUPPLY REGISTERS/GRILLES

- A. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille, two-way deflection. Refer to equipment schedule for blade spacing and orientation.
- B. Frame: Contractor shall coordinate frame type with the Architectural Reflected Ceiling plans.
- C. Construction: Made of aluminum extrusions with factory enamel finish.
- D. Color: To be selected by Architect from manufacturer's standard range.
- E. Damper: Integral, gang-operated opposed blade type, operable from face.

## 2.7 WALL EXHAUST AND RETURN REGISTERS/GRILLES

- A. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille, one-way deflection. Refer to equipment schedule for blade spacing and orientation.
- B. Frame: Contractor shall coordinate frame type with the Architectural Reflected Ceiling plans.
- C. Construction: Made of aluminum extrusions with factory baked enamel finish.
- D. Color: To be selected by architect from manufacturer's standard range.
- E. Damper: For exhaust applications only, provide integral, gang-operated, opposed blade type, operable from face.

## 2.8 LOUVERS

- A. Type: 6 inch ( 150 mm ) deep with blades on 45 degree slope with center baffle and return bend, heavy channel frame, 1/2 inch ( 13 mm ) square mesh screen over exhaust and 1/2 inch ( 13 mm ) square mesh screen over intake.
- B. Type: Stationary louver with drainable blades.
- C. Construction: Heavy gauge extruded 6063-T5 aluminum.
- D. Color: To be selected by Architect from manufacturer's standard range.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
- C. Install diffusers to ductwork with air tight connection.
- D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.
- E. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 099123.

END OF SECTION

## SECTION 238126.13 - SMALL-CAPACITY SPLIT-SYSTEM AIR CONDITIONERS

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Air-source heat pumps.
- B. Air cooled condensing units.
- C. Indoor air handling (fan and coil) units for ducted systems.
- D. Indoor air handling (fan and coil) units for ductless systems.
- E. Controls.

## 1.2 RELATED REQUIREMENTS

- A. Section 233100 - HVAC Ducts and Casings.
- B. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections and installation and wiring of thermostats and other controls components.

## 1.3 REFERENCE STANDARDS

- A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment 2008, Including All Addenda.
- B. AHRI 520 - Performance Rating of Positive Displacement Condensing Units 2004.
- C. ASHRAE Std 15 - Safety Standard for Refrigeration Systems and Designation and Classification of Refrigerants 2019.
- D. ASHRAE Std 23.1 - Methods for Performance Testing Positive Displacement Refrigerant Compressors and Condensing Units that Operate at Subcritical Pressures of the Refrigerant 2019.
- E. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. NEMA MG 1 - Motors and Generators 2018.
- G. NFPA 54 - National Fuel Gas Code 2018.
- H. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2018.
- I. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems 2018.
- J. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical Current Edition, Including All Revisions.

## 1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.
- C. Sustainable Design Documentation: Submit manufacturer's product data on refrigerant used, showing compliance with specified requirements.
- D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
- E. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Filters: One for each unit.



## 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum [ ] years of experience and approved by manufacturer.

## 1.6 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide three year manufacturers warranty for solid state ignition modules.
- C. Provide five year manufacturers warranty for heat exchangers.
- D. Provide five year manufacturers warranty for electronic air cleaners.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Carrier Corporation
- B. Trane Inc
- C. York
- D. Daikin

### 2.2 SYSTEM DESIGN

- A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.
  - 1. Heating and Cooling: Air-source electric heat pump located in outdoor unit with evaporator.
  - 2. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.
- B. Performance Requirements: See Schedule for all requirements.
- C. Electrical Characteristics: Refer to Electrical Documents for electrical characteristics.

### 2.3 INDOOR AIR HANDLING UNITS FOR DUCTED SYSTEMS

- A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating and cooling element(s), controls, and accessories; wired for single power connection with control transformer.
  - 1. Air Flow Configuration: Horizontal.
  - 2. Cabinet: Steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.
- B. Supply Fan: Centrifugal type rubber mounted with direct or belt drive with adjustable variable pitch motor pulley.
- C. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
  - 1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
  - 2. Manufacturers: System manufacturer.

### 2.4 INDOOR AIR HANDLING UNITS FOR DUCTLESS SYSTEMS

- A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, evaporator coil, and controls; wired for single power connection with control transformer.
  - 1. Location: High-wall.
  - 2. Cabinet: Galvanized steel.
  - 3. Fan: Line-flow fan direct driven by a single motor.

4. Filter return air with washable, antioxidant pre-filter and a pleated anti-allergy enzyme filter.
- B. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
  1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
  2. Manufacturer: System manufacturer.

## 2.5 OUTDOOR UNITS

- A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.
  1. Comply with AHRI 210/240.
  2. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.
  3. Refrigerant: R-410A.
  4. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.
  5. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23.1 and UL 207.
- B. Air Cooled Condenser: Aluminum fin and copper tube coil, AHRI 520 with direct drive axial propeller fan resiliently mounted, galvanized fan guard.
- C. Accessories: Filter drier, high pressure switch (manual reset), low pressure switch (automatic reset), service valves and gauge ports, thermometer well (in liquid line).
  1. Provide thermostatic expansion valves.
  2. Provide heat pump reversing valves depending on type of unit.
- D. Operating Controls:
  1. Control by room thermostat to maintain room temperature setting.
  2. Low Ambient Kit: Provide refrigerant pressure switch to cycle condenser fan on when condenser refrigerant pressure is above 285 psig ( 1965 kPa ) and off when pressure drops below 140 psig ( 965 kPa ) for operation to 0 degrees F ( -18 degrees C ).

## 2.6 ACCESSORY EQUIPMENT

- A. Economizer Damper Units: Steel cabinet with baked enamel finish, easily removed and secured access doors, glass fiber insulation.
  1. Dampers: Formed steel with nylon bearings and gaskets.
  2. Damper Operator: 24 volt, three position spring return motor with adjustable minimum position switch.
  3. Control Wiring: Provide wiring harness consisting of control board with relays, wiring harness, transformer, and hardware.
  4. Controls: Discharge air thermostat, adjustable outdoor air "enthalpy" control, return air "enthalpy" sensor position dampers, and interface to room thermostat.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.
- B. Verify that proper power supply is available and in correct location.

### 3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions and requirements of local authorities having jurisdiction.
- B. Install in accordance with NFPA 90A and NFPA 90B.
- C. Install refrigeration systems in accordance with ASHRAE Std 15.
- D. Pipe drain from cooling coils to nearest storm drain.

END OF SECTION

## SECTION 238216 - AIR COILS

## PART 1 GENERAL

## 1.1 RELATED REQUIREMENTS

- A. Section 233100 - HVAC Ducts and Casings: Installation of duct coils.
- B. Section 260583 - Wiring Connections: Electrical characteristics and wiring connections.

## 1.2 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2005 (Revised 2009).

## 1.3 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions.
- C. Shop Drawings: Indicate coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions.
- D. Certificates: Certify that coil capacities, pressure drops, and selection procedures meet or exceed specified requirements.
- E. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

## 1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect coil fins from crushing and bending by leaving in shipping cases until installation, and by storing indoors.
- B. Protect coils from entry of dirt and debris with pipe caps or plugs.

## PART 2 PRODUCTS

## 2.1 ELECTRIC COILS

- A. Assembly: UL listed and labelled, with terminal control box and hinged cover, splice box, coil, casing, and controls.
- B. Coil: Exposed helical coil of nickel-chrome resistance wire with refractory ceramic support bushings.
- C. Controls: Automatic reset thermal cut-out, built-in magnetic contactors, control circuit transformer and fuse, manual reset thermal cut-out, air flow proving device, fused disconnect, load fuses.

## PART 3 EXECUTION

## 3.1 INSTALLATION

- A. Install in accordance with manufacturer's written instructions.
- B. Install in ducts and casings in accordance with SMACNA (DCS).
  - 1. Support coil sections independent of piping on steel channel or double angle frames and secure to casings.
  - 2. Arrange supports to avoid piercing drain pans.
  - 3. Provide airtight seal between coil and duct or casing.
- C. Protect coils to prevent damage to fins and flanges. Comb out bent fins.

- D. Electric Duct Coils: Wire in accordance with NFPA 70. Refer to Section 260583.  
END OF SECTION

## SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Single conductor building wire.
- B. Underground feeder and branch-circuit cable.
- C. Service entrance cable.
- D. Metal-clad cable.
- E. Wiring connectors.
- F. Electrical tape.
- G. Heat shrink tubing.
- H. Oxide inhibiting compound.
- I. Wire pulling lubricant.
- J. Cable ties.

#### 1.2 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.
- B. Section 260526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

#### 1.3 REFERENCE STANDARDS

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire 2013 (Reapproved 2018).
- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft 2011 (Reapproved 2017).
- C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes 2010 (Reapproved 2014).
- D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation 2004 (Reapproved 2014).
- E. ASTM B800 - Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes - Annealed and Intermediate Tempers 2005 (Reapproved 2015).
- F. ASTM B801 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy Wire for Subsequent Covering of Insulation 2018.
- G. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape 2017.
- H. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes 2013.
- I. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- J. NECA 104 - Recommended Practice for Installing Aluminum Building Wire and Cable 2012.
- K. NECA 120 - Standard for Installing Armored Cable (AC) and Metal-Clad Cable (MC) 2012.
- L. NECA 121 - Standard for Installing Nonmetallic-Sheathed Cable (Type NM-B) and Underground Feeder and Branch-Circuit Cable (Type UF) 2007.
- M. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy 2009.
- N. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- O. UL 44 - Thermoset-Insulated Wires and Cables Current Edition, Including All Revisions.

- P. UL 83 - Thermoplastic-Insulated Wires and Cables Current Edition, Including All Revisions.
- Q. UL 486A-486B - Wire Connectors Current Edition, Including All Revisions.
- R. UL 486C - Splicing Wire Connectors Current Edition, Including All Revisions.
- S. UL 486D - Sealed Wire Connector Systems Current Edition, Including All Revisions.
- T. UL 493 - Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables Current Edition, Including All Revisions.
- U. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape Current Edition, Including All Revisions.
- V. UL 854 - Service-Entrance Cables Current Edition, Including All Revisions.
- W. UL 1569 - Metal-Clad Cables Current Edition, Including All Revisions.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
  - 2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
  - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

#### 1.5 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

### PART 2 PRODUCTS

#### 2.1 CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
- C. Nonmetallic-sheathed cable is permitted only as follows:
  - 1. Where not otherwise restricted, may be used:
    - a. For branch circuit wiring in dry locations within one- and two-family dwellings and their attached or detached garages, and their storage buildings.
    - b. For branch circuit wiring in dry locations within multifamily dwellings permitted to be of Types III, IV, and V construction.
- D. Service entrance cable is permitted only as follows:
  - 1. Where not otherwise restricted, may be used:
    - a. For underground service entrance, installed in raceway.
- E. Metal-clad cable is permitted only as follows:
  - 1. Where not otherwise restricted, may be used:
    - a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.
      - 1) Maximum Length: 6 feet ( 1.8 m ).
    - b. Where concealed in hollow stud walls, above accessible ceilings and under raised floors for branch circuits up to 20 A.

2. In addition to other applicable restrictions, may not be used:
  - a. Where exposed to view, except in dedicated electrical, communications, and mechanical rooms where not subject to damage.
  - b. Where exposed to damage.
  - c. For damp, wet, or corrosive locations, unless provided with a PVC jacket listed as suitable for those locations.

## 2.2 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Provide new conductors and cables manufactured not more than one year prior to installation.
- D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- E. Comply with NEMA WC 70.
- F. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- G. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- H. Conductor Material:
  1. Provide copper conductors except where aluminum conductors are specifically indicated or permitted for substitution. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.
    - a. Substitution of aluminum conductors for copper is permitted, when approved by Owner and authority having jurisdiction, only for the following:
      - 1) Services: Copper conductors size 1/0 AWG and larger.
      - 2) Feeders: Copper conductors size 1/0 AWG and larger.
    - b. Where aluminum conductors are substituted for copper, comply with the following:
      - 1) Size aluminum conductors to provide, when compared to copper sizes indicated, equivalent or greater ampacity and equivalent or less voltage drop.
      - 2) Increase size of raceways, boxes, wiring gutters, enclosures, etc. as required to accommodate aluminum conductors.
  2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
  3. Tinned Copper Conductors: Comply with ASTM B33.
  4. Aluminum Conductors (only where specifically indicated or permitted for substitution): AA-8000 series aluminum alloy conductors recognized by ASTM B800 and compact stranded in accordance with ASTM B801 unless otherwise indicated.
- I. Minimum Conductor Size:
  1. Branch Circuits: 12 AWG.
    - a. Exceptions:
      - 1) 20 A, 120 V circuits longer than 75 feet ( 23 m ): 10 AWG, for voltage drop.
      - 2) 20 A, 120 V circuits longer than 150 feet ( 46 m ): 8 AWG, for voltage drop.



- J. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
  - K. Conductor Color Coding:
    - 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
    - 2. Color Coding Method: Integrally colored insulation.
    - 3. Color Code:
      - a. 208Y/120 V, 3 Phase, 4 Wire System:
        - 1) Phase A: Black.
        - 2) Phase B: Red.
        - 3) Phase C: Blue.
        - 4) Neutral/Grounded: White.
      - b. Equipment Ground, All Systems: Green.
      - c. Travelers for 3-Way and 4-Way Switching: Pink.
- 2.3 SINGLE CONDUCTOR BUILDING WIRE
- A. Description: Single conductor insulated wire.
  - B. Conductor Stranding:
    - 1. Feeders and Branch Circuits:
      - a. Size 10 AWG and Smaller: Solid.
      - b. Size 8 AWG and Larger: Stranded.
  - C. Insulation Voltage Rating: 600 V.
  - D. Insulation:
    - 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
      - a. Size 4 AWG and Larger: Type XHHW-2.
      - b. Installed Underground: Type XHHW-2.
- 2.4 UNDERGROUND FEEDER AND BRANCH-CIRCUIT CABLE
- A. Description: NFPA 70, Type UF multiple-conductor cable listed and labeled as complying with UL 493, Type UF-B.
  - B. Provide equipment grounding conductor unless otherwise indicated.
  - C. Conductor Stranding:
    - 1. Size 10 AWG and Smaller: Solid.
    - 2. Size 8 AWG and Larger: Stranded.
  - D. Insulation Voltage Rating: 600 V.
- 2.5 SERVICE ENTRANCE CABLE
- A. Service Entrance Cable for Underground Use: NFPA 70, Type USE single-conductor cable listed and labeled as complying with UL 854, Type USE-2, and with UL 44 Type RHH/RHW-2.
  - B. Conductor Stranding: Stranded.
  - C. Insulation Voltage Rating: 600 V.
- 2.6 METAL-CLAD CABLE
- A. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.
  - B. Conductor Stranding:
    - 1. Size 10 AWG and Smaller: Solid.
    - 2. Size 8 AWG and Larger: Stranded.
  - C. Insulation Voltage Rating: 600 V.
  - D. Insulation: Type THHN, THHN/THWN or THHN/THWN-2.
  - E. Grounding: Full-size integral equipment grounding conductor.

- F. Armor: Steel, interlocked tape.
- G. Provide PVC jacket applied over cable armor where indicated or required for environment of installed location.

## 2.7 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
- B. Connectors for Grounding and Bonding: Comply with Section 260526.
- C. Wiring Connectors for Splices and Taps:
  - 1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
  - 2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
  - 3. Connectors for Aluminum Conductors: Use compression connectors.
- D. Wiring Connectors for Terminations:
  - 1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
  - 2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
  - 3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
  - 4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
  - 5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
  - 6. Aluminum Conductors: Use compression connectors for all connections.
  - 7. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
- E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.
- F. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F ( 105 degrees C ) for standard applications and 302 degrees F ( 150 degrees C ) for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
- G. Mechanical Connectors: Provide bolted type or set-screw type.
- H. Compression Connectors: Provide circumferential type or hex type crimp configuration.
- I. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

## 2.8 ACCESSORIES

- A. Electrical Tape:
  - 1. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil ( 0.18 mm ); resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F ( -18 degrees C ) and suitable for continuous temperature environment up to 221 degrees F ( 105 degrees C ).

2. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil ( 0.76 mm ); suitable for continuous temperature environment up to 194 degrees F ( 90 degrees C ) and short-term 266 degrees F ( 130 degrees C ) overload service.
3. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil ( 3.2 mm ); suitable for continuous temperature environment up to 176 degrees F ( 80 degrees C ).
4. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil ( 2.3 mm ).
- B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
- C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
- D. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.
- E. Cable Ties: Material and tensile strength rating suitable for application.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that work likely to damage wire and cable has been completed.
- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- D. Verify that field measurements are as indicated.
- E. Verify that conditions are satisfactory for installation prior to starting work.

### 3.2 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

### 3.3 INSTALLATION

- A. Circuiting Requirements:
  1. Unless dimensioned, circuit routing indicated is diagrammatic.
  2. When circuit destination is indicated without specific routing, determine exact routing required.
  3. Arrange circuiting to minimize splices.
  4. Include circuit lengths required to install connected devices within 10 ft ( 3.0 m ) of location indicated.
  5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
  6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
  7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
    - a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
    - b. Increase size of conductors as required to account for ampacity derating.
    - c. Size raceways, boxes, etc. to accommodate conductors.

8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
- B. Install products in accordance with manufacturer's instructions.
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Install aluminum conductors in accordance with NECA 104.
- E. Install underground feeder and branch-circuit cable (Type UF-B) in accordance with NECA 121.
- F. Install metal-clad cable (Type MC) in accordance with NECA 120.
- G. Installation in Raceway:
  1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
  2. Pull all conductors and cables together into raceway at same time.
  3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
  4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- H. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- I. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
- J. Terminate cables using suitable fittings.
  1. Metal-Clad Cable (Type MC):
    - a. Use listed fittings.
    - b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.
- K. Install conductors with a minimum of 12 inches ( 300 mm ) of slack at each outlet.
- L. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- M. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- N. Make wiring connections using specified wiring connectors.
  1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
  2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
  3. Do not remove conductor strands to facilitate insertion into connector.
  4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
  5. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.
  6. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
  7. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

- O. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
  - 1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape or heat shrink tubing.
    - a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
  - 2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape or heat shrink tubing.
    - a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
    - b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
- P. Insulate ends of spare conductors using vinyl insulating electrical tape.
- Q. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.
- R. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

END OF SECTION

**SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS****PART 1 GENERAL****1.1 SECTION INCLUDES**

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.
- D. Ground rod electrodes.

**1.2 RELATED REQUIREMENTS**

- A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
- B. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

**1.3 REFERENCE STANDARDS**

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings 2017.
- C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. UL 467 - Grounding and Bonding Equipment Current Edition, Including All Revisions.

**1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Verify exact locations of underground metal water service pipe entrances to building.
  - 2. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
  - 1. Do not install ground rod electrodes until final backfill and compaction is complete.

**PART 2 PRODUCTS****2.1 GROUNDING AND BONDING REQUIREMENTS**

- A. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- D. Grounding Electrode System:
  - 1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
    - a. Provide continuous grounding electrode conductors without splice or joint.
    - b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
  - 2. Metal Underground Water Pipe(s):
    - a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth

- for at least 10 feet ( 3.0 m ) at an accessible location not more than 5 feet ( 1.5 m ) from the point of entrance to the building.
- b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
  - c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
3. Ground Rod Electrode(s):
- a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
  - b. Space electrodes not less than 10 feet ( 3.0 m ) from each other and any other ground electrode.
  - c. Where location is not indicated, locate electrode(s) at least 5 feet ( 1.5 m ) outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
- E. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
  2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
  3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
  4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
  5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
  6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
  7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
    - a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
    - b. Metal gas piping.
  8. Provide bonding for metal building frame.
  9. Provide bonding and equipment grounding for pools and fountains and associated equipment in accordance with NFPA 70.
- F. Communications Systems Grounding and Bonding:
1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
- 2.2 GROUNDING AND BONDING COMPONENTS
- A. General Requirements:
1. Provide products listed, classified, and labeled as suitable for the purpose intended.

2. Provide products listed and labeled as complying with UL 467 where applicable.
- B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 260526:
  1. Use insulated copper conductors unless otherwise indicated.
    - a. Exceptions:
      - 1) Use bare copper conductors where installed underground in direct contact with earth.
      - 2) Use bare copper conductors where directly encased in concrete (not in raceway).
- C. Connectors for Grounding and Bonding:
  1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
  2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
  3. Unless otherwise indicated, use mechanical connectors, compression connectors or exothermic welded connections for accessible connections.
- D. Ground Rod Electrodes:
  1. Comply with NEMA GR 1.
  2. Material: Copper-bonded (copper-clad) steel.
  3. Size: 3/4 inch ( 19 mm ) diameter by 10 feet ( 3.0 m ) length, unless otherwise indicated.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
- D. Make grounding and bonding connections using specified connectors.
  1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
  2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
  3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
  4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
  5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- E. Identify grounding and bonding system components in accordance with Section 260553.

END OF SECTION



**SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS****PART 1 GENERAL****1.1 SECTION INCLUDES**

- A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

**1.2 RELATED REQUIREMENTS**

- A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 260533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.
- C. Section 260533.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.
- D. Section 265100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.
- E. Section 265600 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

**1.3 REFERENCE STANDARDS**

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2019.
- D. MFMA-4 - Metal Framing Standards Publication 2004.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

**1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
  - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
  - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
  - 4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
  - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
  - 1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 033000.

**PART 2 PRODUCTS****2.1 SUPPORT AND ATTACHMENT COMPONENTS**

- A. General Requirements:
  - 1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
  - 2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.

3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
  - a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
  - b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
  1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
  2. Conduit Clamps: Bolted type unless otherwise indicated.
- C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
- D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
  1. Comply with MFMA-4.
- E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
- F. Anchors and Fasteners:
  1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- G. Equipment Support and Attachment:
  1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
  2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
  3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
  4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- H. Secure fasteners according to manufacturer's recommended torque settings.

- I. Remove temporary supports.

END OF SECTION

## SECTION 260533.13 - CONDUIT FOR ELECTRICAL SYSTEMS

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Aluminum rigid metal conduit (RMC).
- C. Intermediate metal conduit (IMC).
- D. PVC-coated galvanized steel rigid metal conduit (RMC).
- E. Flexible metal conduit (FMC).
- F. Electrical metallic tubing (EMT).
- G. Rigid polyvinyl chloride (PVC) conduit.
- H. Reinforced thermosetting resin conduit (RTRC).
- I. Conduit fittings.
- J. Accessories.

## 1.2 RELATED REQUIREMENTS

- A. Section 078400 - Firestopping.
- B. Section 260526 - Grounding and Bonding for Electrical Systems.
- C. Section 260529 - Hangers and Supports for Electrical Systems.
- D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 312316 - Excavation.
- F. Section 312323 - Fill: Bedding and backfilling.

## 1.3 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC) 2015.
- B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S) 2015.
- C. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A) 2015.
- D. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit (EIMC) 2018.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- F. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT) 2013.
- G. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit 2004.
- H. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC) 2017.
- I. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.
- J. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit 2018.
- K. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit 2013.
- L. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing 2016.
- M. NEMA TC 14 (SERIES) - Reinforced Thermosetting Resin Conduit and Fittings Series 2015.
- N. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- O. UL 1 - Flexible Metal Conduit Current Edition, Including All Revisions.
- P. UL 6 - Electrical Rigid Metal Conduit-Steel Current Edition, Including All Revisions.

- Q. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel Current Edition, Including All Revisions.
- R. UL 514B - Conduit, Tubing, and Cable Fittings Current Edition, Including All Revisions.
- S. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings Current Edition, Including All Revisions.
- T. UL 797 - Electrical Metallic Tubing-Steel Current Edition, Including All Revisions.
- U. UL 1242 - Electrical Intermediate Metal Conduit-Steel Current Edition, Including All Revisions.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

##### A. Coordination:

1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

##### B. Sequencing:

1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

#### PART 2 PRODUCTS

##### 2.1 CONDUIT APPLICATIONS

##### A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

##### B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

##### C. Underground:

1. Under Slab on Grade: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit or reinforced thermosetting resin conduit (RTRC).
2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit or reinforced thermosetting resin conduit (RTRC).
3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit or reinforced thermosetting resin conduit (RTRC).
4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
5. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.

6. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape to provide supplementary corrosion protection or use PVC-coated galvanized steel rigid metal conduit.
  - D. Embedded Within Concrete:
    1. Within Slab on Grade (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit or reinforced thermosetting resin conduit (RTRC).
    2. Within Slab Above Ground (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit or reinforced thermosetting resin conduit (RTRC).
    3. Within Concrete Walls Above Ground: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit or reinforced thermosetting resin conduit (RTRC).
    4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from concrete.
  - E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC) or electrical metallic tubing (EMT).
  - F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC) or electrical metallic tubing (EMT).
  - G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC) or electrical metallic tubing (EMT).
  - H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit.
  - I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC) or electrical metallic tubing (EMT).
  - J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
  - K. Exposed, Exterior: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC) or PVC-coated galvanized steel rigid metal conduit.
  - L. Corrosive Locations Above Ground: Use PVC-coated galvanized steel rigid metal conduit, aluminum rigid metal conduit or reinforced thermosetting resin conduit (RTRC).
  - M. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
- ## 2.2 CONDUIT REQUIREMENTS
- A. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.
  - B. Provide products listed, classified, and labeled as suitable for the purpose intended.
  - C. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- ## 2.3 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)
- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
  - B. Fittings:
    1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

2. Material: Use steel or malleable iron.
  3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.
- 2.4 ALUMINUM RIGID METAL CONDUIT (RMC)
- A. Description: NFPA 70, Type RMC aluminum rigid metal conduit complying with ANSI C80.5 and listed and labeled as complying with UL 6A.
  - B. Fittings:
    1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
    2. Material: Use aluminum.
    3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.
- 2.5 INTERMEDIATE METAL CONDUIT (IMC)
- A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
  - B. Fittings:
    1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
    2. Material: Use steel or malleable iron.
    3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.
- 2.6 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)
- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.
  - B. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil ( 1.02 mm ).
  - C. PVC-Coated Fittings:
    1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
    2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
    3. Material: Use steel or malleable iron.
    4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil ( 1.02 mm ).
  - D. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil ( 0.38 mm ).
- 2.7 FLEXIBLE METAL CONDUIT (FMC)
- A. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.
  - B. Fittings:
    1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
    2. Material: Use steel or malleable iron.
- 2.8 ELECTRICAL METALLIC TUBING (EMT)
- A. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
  - B. Fittings:
    1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

2. Material: Use steel or malleable iron.
3. Connectors and Couplings: Use compression (gland) or set-screw type.
  - a. Do not use indenter type connectors and couplings.

## 2.9 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
- B. Fittings:
  1. Manufacturer: Same as manufacturer of conduit to be connected.
  2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

## 2.10 REINFORCED THERMOSETTING RESIN CONDUIT (RTRC)

- A. Description: NFPA 70, Type RTRC reinforced thermosetting resin conduit complying with NEMA TC 14 (SERIES).
- B. Supports: Per manufacturer's recommendations.
- C. Fittings: Same type and manufacturer as conduit to be connected.

## 2.11 ACCESSORIES

- A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil ( 0.51 mm ).
- B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.
- C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- D. Epoxy Adhesive for RTRC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- E. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.
- F. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Install aluminum rigid metal conduit (RMC) in accordance with NECA 102.
- E. Install intermediate metal conduit (IMC) in accordance with NECA 101.
- F. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.
- G. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- H. Conduit Support:
  1. Secure and support conduits in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
  2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- I. Connections and Terminations:
  1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.



2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
  3. Use suitable adapters where required to transition from one type of conduit to another.
  4. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
  5. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
  6. Secure joints and connections to provide maximum mechanical strength and electrical continuity.
- J. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
  2. Make penetrations perpendicular to surfaces unless otherwise indicated.
  3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
  4. Conceal bends for conduit risers emerging above ground.
  5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
  6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
  7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
  8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.
- K. Underground Installation:
1. Provide trenching and backfilling in accordance with Section 312316 and Section 312323.
  2. Minimum Cover, Unless Otherwise Indicated or Required:
    - a. Underground, Exterior: 24 inches ( 610 mm ).
    - b. Under Slab on Grade: 12 inches ( 300 mm ) to bottom of slab.
  3. Provide underground warning tape in accordance with Section 260553 along entire conduit length for service entrance where not concrete-encased.
- L. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
1. Secure conduits to prevent floating or movement during pouring of concrete.
- M. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
  2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.

3. Where calculated in accordance with NFPA 70 for reinforced thermosetting resin conduit (RTRC) conduit installed above ground to compensate for thermal expansion and contraction.
  4. Where conduits are subject to earth movement by settlement or frost.
  - N. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
    1. Where conduits pass from outdoors into conditioned interior spaces.
    2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
  - O. Provide grounding and bonding in accordance with Section 260526.
- 3.2 CLEANING
- A. Clean interior of conduits to remove moisture and foreign matter.

END OF SECTION

## SECTION 260533.16 - BOXES FOR ELECTRICAL SYSTEMS

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Outlet and device boxes up to 100 cubic inches ( 1,650 cu cm ), including those used as junction and pull boxes.
- B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches ( 1,650 cu cm ).
- C. Floor boxes.
- D. Accessories.

## 1.2 RELATED REQUIREMENTS

- A. Section 083100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.
- B. Section 260526 - Grounding and Bonding for Electrical Systems.
- C. Section 260529 - Hangers and Supports for Electrical Systems.
- D. Section 260533.13 - Conduit for Electrical Systems:
  - 1. Conduit bodies and other fittings.
  - 2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.
- E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 262726 - Wiring Devices:
  - 1. Wall plates.
  - 2. Floor box service fittings.

## 1.3 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2010.
- C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.
- D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports 2013.
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2018.
- F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- H. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- I. UL 508A - UL Standard for Safety Industrial Control Panels 2018.
- J. UL 514A - Metallic Outlet Boxes Current Edition, Including All Revisions.

## 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
  - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
  - 3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.

4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

#### 1.5 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes and underground boxes/enclosures.

#### 1.6 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

### PART 2 PRODUCTS

#### 2.1 BOXES

##### A. General Requirements:

1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled as suitable for the purpose intended.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

##### B. Outlet and Device Boxes Up to 100 cubic inches ( 1,650 cu cm ), Including Those Used as Junction and Pull Boxes:

1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use suitable concrete type boxes where flush-mounted in concrete.
4. Use suitable masonry type boxes where flush-mounted in masonry walls.
5. Use raised covers suitable for the type of wall construction and device configuration where required.
6. Use shallow boxes where required by the type of wall construction.
7. Do not use "through-wall" boxes designed for access from both sides of wall.
8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.

10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
  11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
  12. Wall Plates: Comply with Section 262726.
  - C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches ( 1,650 cu cm ):
    1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
    2. NEMA 250 Environment Type, Unless Otherwise Indicated:
    3. Junction and Pull Boxes Larger Than 100 cubic inches ( 1,650 cu cm ):
      - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
  - D. Floor Boxes:
    1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 262726; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
    2. Manufacturer: Same as manufacturer of floor box service fittings.
- ## 2.2 ACCESSORIES
- A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for boxes and facade materials to be installed.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
- E. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- F. Box Locations:
  1. Locate boxes to be accessible. Provide access panels in accordance with Section 083100 as required where approved by the Architect.
  2. Unless dimensioned, box locations indicated are approximate.
  3. Locate boxes so that wall plates do not span different building finishes.
  4. Locate boxes so that wall plates do not cross masonry joints.
  5. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
  6. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches ( 150 mm ) horizontal separation unless otherwise indicated.

7. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
  - a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches ( 610 mm ) separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
  - b. Do not install flush-mounted boxes with area larger than 16 square inches ( 0.0103 sq m ) or such that the total aggregate area of openings exceeds 100 square inches ( 0.0645 sq m ) for any 100 square feet ( 9.29 sq m ) of wall area.
8. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 260533.13.
9. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
  - a. Concealed above accessible suspended ceilings.
  - b. Within joists in areas with no ceiling.
  - c. Electrical rooms.
  - d. Mechanical equipment rooms.
- G. Box Supports:
  1. Secure and support boxes in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
  2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
  3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
- H. Install boxes plumb and level.
- I. Flush-Mounted Boxes:
  1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch ( 6 mm ) or does not project beyond finished surface.
  2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
  3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch ( 3 mm ) at the edge of the box.
- J. Install boxes as required to preserve insulation integrity.
- K. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.
- L. Nonmetallic Floor Boxes: Cut box flush with finished floor after concrete pour.
- M. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- N. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.
- O. Close unused box openings.

- P. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
  - Q. Provide grounding and bonding in accordance with Section 260526.
  - R. Identify boxes in accordance with Section 260553.
- 3.2 CLEANING
- A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

END OF SECTION

## SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Voltage markers.
- E. Underground warning tape.
- F. Warning signs and labels.

## 1.2 RELATED REQUIREMENTS

- A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
- B. Section 262726 - Wiring Devices - Lutron: Device and wallplate finishes; factory pre-marked wallplates.

## 1.3 REFERENCE STANDARDS

- A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs 2011.
- B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels 2011.
- C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. UL 969 - Marking and Labeling Systems Current Edition, Including All Revisions.

## PART 2 PRODUCTS

## 2.1 IDENTIFICATION REQUIREMENTS

- A. Identification for Equipment:
  - 1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
    - a. Switchboards:
      - 1) Identify ampere rating.
      - 2) Identify voltage and phase.
      - 3) Identify power source and circuit number. Include location when not within sight of equipment.
      - 4) Use identification nameplate to identify main overcurrent protective device.
      - 5) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
    - b. Panelboards:
      - 1) Identify ampere rating.
      - 2) Identify voltage and phase.
      - 3) Identify power source and circuit number. Include location when not within sight of equipment.
      - 4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
      - 5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
      - 6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify



- spares and spaces.
- c. Busway:
  - 1) Identify ampere rating.
  - 2) Identify voltage and phase.
  - 3) Identify power source and circuit number. Include location when not within sight of equipment.
- d. Time Switches:
- e. Enclosed Contactors:
- f. Electricity Meters:
  - 1) Identify load(s) metered.
- 2. Service Equipment:
  - a. Use identification nameplate to identify each service disconnecting means.
  - b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate or means of identification acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.
- 3. Emergency System Equipment:
  - a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
  - b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
- 4. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
- 5. Use identification label or handwritten text using indelible marker on inside of door at each fused switch to identify required NEMA fuse class and size.
- 6. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
- 7. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
  - a. Service equipment.
  - b. Industrial control panels.
  - c. Motor control centers.
  - d. Elevator control panels.
  - e. Industrial machinery.
- B. Identification for Conductors and Cables:
  - 1. Color Coding for Power Conductors 600 V and Less: Comply with Section 260519.
  - 2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
  - 3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
    - a. At each source and load connection.
    - b. Within boxes when more than one circuit is present.

4. Use underground warning tape to identify direct buried cables.
  - C. Identification for Raceways:
    1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet ( 6.1 m ).
    2. Use identification labels, handwritten text using indelible marker or plastic marker tags to identify circuits enclosed for accessible conduits at wall penetrations, at floor penetrations, at roof penetrations and at equipment terminations when source is not within sight.
    3. Use identification labels, handwritten text using indelible marker or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.
    4. Use underground warning tape to identify underground raceways.
  - D. Identification for Devices:
    1. Wiring Device and Wallplate Finishes: Comply with Section 262726.
    2. Use identification label to identify fire alarm system devices.
    3. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.
      - a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.
    4. Use identification label or engraved wallplate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.
  - E. Identification for Luminaires:
    1. Use permanent red dot on luminaire frame to identify luminaires connected to emergency power system.
- ## 2.2 IDENTIFICATION NAMEPLATES AND LABELS
- A. Identification Nameplates:
    1. Materials:
      - a. Indoor Clean, Dry Locations: Use plastic nameplates.
      - b. Outdoor Locations: Use plastic, stainless steel or aluminum nameplates suitable for exterior use.
    2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch ( 1.6 mm ); engraved text.
    3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch ( 0.8 mm ); engraved or laser-etched text.
    4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch ( 0.8 mm ); engraved or laser-etched text.
    5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch ( 25 mm ) high; Four, located at corners for larger sizes.
  - B. Identification Labels:
    1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
    2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
- ## 2.3 WIRE AND CABLE MARKERS
- A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve,

plastic clip-on or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

- B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.
- C. Legend: Power source and circuit number or other designation indicated.
- D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
- E. Minimum Text Height: 1/8 inch ( 3 mm ).
- F. Color: Black text on white background unless otherwise indicated.

## 2.4 VOLTAGE MARKERS

- A. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth or vinyl snap-around type markers.
- B. Minimum Size:
  - 1. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
- C. Legend:
  - 1. Markers for Voltage Identification: Highest voltage present.
- D. Color: Black text on orange background unless otherwise indicated.

## 2.5 UNDERGROUND WARNING TAPE

- A. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
- B. Non-detectable Type Tape: 6 inches ( 152 mm ) wide, with minimum thickness of 4 mil ( 0.1 mm ).
- C. Legend: Type of service, continuously repeated over full length of tape.
- D. Color:

## 2.6 WARNING SIGNS AND LABELS

- A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
- B. Warning Signs:
  - 1. Materials:
    - a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
  - 2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
  - 3. Minimum Size: 7 by 10 inches ( 178 by 254 mm ) unless otherwise indicated.
- C. Warning Labels:
  - 1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
  - 2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
  - 3. Minimum Size: 2 by 4 inches ( 51 mm by 102 mm ) unless otherwise indicated.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

### 3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:

1. Surface-Mounted Equipment: Enclosure front.
  2. Flush-Mounted Equipment: Inside of equipment door.
  3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
  4. Elevated Equipment: Legible from the floor or working platform.
  5. Branch Devices: Adjacent to device.
  6. Interior Components: Legible from the point of access.
  7. Conduits: Legible from the floor.
  8. Boxes: Outside face of cover.
  9. Conductors and Cables: Legible from the point of access.
  10. Devices: Outside face of cover.
- C. Install identification products centered, level, and parallel with lines of item being identified.
- D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- F. Install underground warning tape above buried lines with one tape per trench at 3 inches ( 75 mm ) below finished grade.
- G. Secure rigid signs using stainless steel screws.
- H. Mark all handwritten text, where permitted, to be neat and legible.

END OF SECTION

## SECTION 260923 - LIGHTING CONTROL DEVICES

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Occupancy sensors.
- B. Time switches.
- C. Outdoor photo controls.
- D. Lighting contactors.

## 1.2 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 260529 - Hangers and Supports for Electrical Systems
- C. Section 260533.16 - Boxes for Electrical Systems.
- D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 262726 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers and fan speed controllers.
- F. Section 265100 - Interior Lighting.
- G. Section 265600 - Exterior Lighting.

## 1.3 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2010.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2018.
- D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts 2000, with Errata (2008).
- E. NEMA ICS 6 - Industrial Control and Systems: Enclosures 1993 (Reaffirmed 2016).
- F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control Current Edition, Including All Revisions.
- H. UL 916 - Energy Management Equipment Current Edition, Including All Revisions.
- I. UL 917 - Clock-Operated Switches Current Edition, Including All Revisions.
- J. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules Current Edition, Including All Revisions.
- K. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contactors and Motor-starters - Electromechanical Contactors and Motor-starters Current Edition, Including All Revisions.

## 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
  - 2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
  - 3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
  - 4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.
- B. Sequencing:

1. Do not install lighting control devices until final surface finishes and painting are complete.

#### 1.5 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
  1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.
- C. Field Quality Control Reports.
- D. Project Record Documents: Record actual installed locations and settings for lighting control devices.

#### 1.6 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

#### 1.7 DELIVERY, STORAGE, AND PROTECTION

- A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

### PART 2 PRODUCTS

#### 2.1 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

#### 2.2 OCCUPANCY SENSORS

- A. All Occupancy Sensors:
  1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
  2. Sensor Technology:
    - a. Passive Infrared (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.
    - b. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.
    - c. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
  3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
  4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
  5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
  6. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.
  7. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
  8. Sensitivity: Field adjustable.

9. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
  - B. Wall Switch Occupancy Sensors:
    1. All Wall Switch Occupancy Sensors:
      - a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
      - b. Unless otherwise indicated or required to control the load indicated on drawings, provide line voltage units with self-contained relay.
      - c. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
      - d. Finish: Color to be selected by the architect.
  - C. Ceiling Mounted Occupancy Sensors:
    1. All Ceiling Mounted Occupancy Sensors:
      - a. Description: Low profile occupancy sensors designed for ceiling installation.
- ## 2.3 TIME SWITCHES
- A. Digital Electronic Time Switches:
    1. Description: Factory-assembled solid state programmable controller with LCD display, listed and labeled as complying with UL 916 or UL 917.
    2. Program Capability:
      - a. Astronomic Time Switches: Single channel, capable of different schedule for each day of the week with additional holiday schedule available to override normal schedule for selected days and field-configurable astronomic feature to automatically adjust for seasonal changes in sunrise and sunset times.
    3. Schedule Capacity: Not less than 16 programmable on/off operations.
    4. Provide automatic daylight savings time and leap year compensation.
    5. Provide power outage backup to retain programming and maintain clock.
    6. Manual override: Capable of overriding current schedule both permanently and temporarily until next scheduled event.
    7. Input Supply Voltage: 120 V ac unless otherwise indicated.
    8. Provide lockable enclosure; environmental type per NEMA 250 as specified for the following installation locations:
      - a. Indoor clean, dry locations: Type 1.
      - b. Outdoor locations: Type 3R.
- ## 2.4 OUTDOOR PHOTO CONTROLS
- A. Stem-Mounted Outdoor Photo Controls:
    1. Description: Direct-wired photo control unit with threaded conduit mounting stem and field-adjustable swivel base, listed and labeled as complying with UL 773A.
    2. Housing: Weatherproof, impact resistant polycarbonate.
    3. Photo Sensor: Cadmium sulfide.
    4. Provide external sliding shield for field adjustment of light level activation.

5. Light Level Activation: 1 to 5 footcandles ( 10.8 to 53.8 lux ) turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
6. Voltage: As required to control the load indicated on the drawings.
7. Failure Mode: Fails to the on position.
8. Load Rating: As required to control the load indicated on the drawings.

## 2.5 LIGHTING CONTACTORS

- A. Description: Magnetic lighting contactors complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; noncombination type unless otherwise indicated; ratings, configurations and features as indicated on the drawings.
- B. Short Circuit Current Rating:
  1. Provide contactors with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
- C. Enclosures:
  1. Comply with NEMA ICS 6.
  2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
  3. Finish: Manufacturer's standard unless otherwise indicated.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of lighting control devices provided under this section.
  1. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.
  2. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches ( 80 mm ) from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
- C. Install lighting control devices in accordance with manufacturer's instructions.
- D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- E. Install lighting control devices plumb and level, and held securely in place.
- F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 262726.
- G. Provide required supports in accordance with Section 260529.
- H. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- I. Occupancy Sensor Locations:
  1. Location Adjustments: Within the design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage.



2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet ( 1.2 m ) from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.
  - J. Outdoor Photo Control Locations:
    1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.
    2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by the photo control itself.
  - K. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.
- 3.2 FIELD QUALITY CONTROL
- A. See Section 014000 - Quality Requirements, for additional requirements.
  - B. Inspect each lighting control device for damage and defects.
  - C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.
  - D. Test time switches to verify proper operation.
  - E. Test outdoor photo controls to verify proper operation, including time delays where applicable.
  - F. Correct wiring deficiencies and replace damaged or defective lighting control devices.
- 3.3 ADJUSTING
- A. Adjust devices and wall plates to be flush and level.
  - B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.
  - C. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Architect. Record settings in written report to be included with submittals.
  - D. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Architect.
- 3.4 CLEANING
- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.
- 3.5 CLOSEOUT ACTIVITIES
- A. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
    1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

END OF SECTION

## SECTION 262100 - LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Electrical service requirements.

## 1.2 RELATED REQUIREMENTS

- A. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.
- B. Section 260526 - Grounding and Bonding for Electrical Systems.
- C. Section 260529 - Hangers and Supports for Electrical Systems.
- D. Section 260533.13 - Conduit for Electrical Systems.
- E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 262413 - Switchboards: Service entrance equipment.
- G. Section 262416 - Panelboards: Service entrance equipment.
- H. Section 264300 - Surge Protective Devices: Service entrance surge protective devices.
- I. Section 312316 - Excavation.
- J. Section 312323 - Fill: Bedding and backfilling.

## 1.3 DEFINITIONS

- A. Service Point: The point of connection between the facilities of the serving utility and the premises wiring as defined in NFPA 70, and as designated by the Utility Company.

## 1.4 REFERENCE STANDARDS

- A. IEEE C2 - National Electrical Safety Code 2017.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

## 1.5 ADMINISTRATIVE REQUIREMENTS

- A. No later than two weeks following date of the Agreement, notify Utility Company of anticipated date of service.
- B. Coordination:
  - 1. Verify the following with Utility Company representative:
    - a. Utility Company requirements, including division of responsibility.
    - b. Exact location and details of utility point of connection.
    - c. Utility easement requirements.
    - d. Utility Company charges associated with providing service.
  - 2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for electrical service and associated equipment.
  - 3. Coordinate arrangement of service entrance equipment with the dimensions and clearance requirements of the actual equipment to be installed.
  - 4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- C. Arrange for Utility Company to provide permanent electrical service. Prepare and submit documentation required by Utility Company.
- D. Utility Company charges associated with providing permanent service to be paid by Owner.
- E. Preinstallation Meeting: Convene one week prior to commencing work of this section to review service requirements and details with Utility Company representative.

## F. Scheduling:

1. Arrange for inspections necessary to obtain Utility Company approval of installation.

## 1.6 QUALITY ASSURANCE

## A. Comply with the following:

1. IEEE C2 (National Electrical Safety Code).
2. NFPA 70 (National Electrical Code).
3. The requirements of the Utility Company.

## PART 2 PRODUCTS

## 2.1 ELECTRICAL SERVICE REQUIREMENTS

- A. Provide new electrical service consisting of all required conduits, conductors, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment.
- B. Electrical Service Characteristics: As indicated on drawings.
- C. Products Furnished by Contractor: Comply with Utility Company requirements.

## PART 3 EXECUTION

## 3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions and Utility Company requirements.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances and required maintenance access.
- D. Provide required trenching and backfilling in accordance with Section 312316 and Section 312323.
- E. Provide required support and attachment components in accordance with Section 260529.
- F. Provide grounding and bonding for service entrance equipment in accordance with Section 260526.
- G. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 260553.

END OF SECTION

## SECTION 262413 - SWITCHBOARDS

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Low-voltage (600 V and less) switchboards and associated accessories for service and distribution applications.
- B. Overcurrent protective devices for switchboards.

## 1.2 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 260526 - Grounding and Bonding for Electrical Systems.
- C. Section 260529 - Hangers and Supports for Electrical Systems.
- D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 262100 - Low-Voltage Electrical Service Entrance.
- F. Section 264300 - Surge Protective Devices.

## 1.3 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service 2013e (Amended 2017).
- B. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers 2016.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- D. NECA 400 - Standard for Installing and Maintaining Switchboards 2007.
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2018.
- F. NEMA PB 2 - Deadfront Distribution Switchboards 2011.
- G. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less 2013.
- H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.
- I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.
- K. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.
- L. UL 891 - Switchboards Current Edition, Including All Revisions.

## 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
  - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
  - 3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
  - 4. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.
  - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Service Entrance Switchboards:

1. Coordinate with Utility Company to provide switchboards with suitable provisions for electrical service and utility metering, where applicable.
2. Coordinate with Owner to arrange for Utility Company required access to equipment for installation and maintenance.
3. Obtain Utility Company approval of switchboard prior to fabrication.
4. Arrange for inspections necessary to obtain Utility Company approval of installation.

#### 1.5 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for switchboards, enclosures, overcurrent protective devices, and other installed components and accessories.
- C. Shop Drawings: Indicate dimensions, voltage, bus ampacities, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
  1. Include dimensioned plan and elevation views of switchboards and adjacent equipment with all required clearances indicated.
  2. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.

#### 1.6 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store switchboards in accordance with manufacturer's instructions, NECA 400 and NEMA PB 2.1.
- B. Store in a clean, dry space having a uniform temperature to prevent condensation (including outdoor switchboards, which are not weatherproof until completely and properly installed). Where necessary, provide temporary enclosure space heaters or temporary power for permanent factory-installed space heaters.
- C. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- D. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

#### 1.8 FIELD CONDITIONS

- A. Maintain field conditions within required service conditions during and after installation.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Switchboards:
  1. Eaton Corporation; [\_\_\_\_]: [www.eaton.com/#sle](http://www.eaton.com/#sle).
  2. Schneider Electric; Square D Products: [www.schneider-electric.us/#sle](http://www.schneider-electric.us/#sle).
  3. Siemens Industry, Inc: [www.usa.siemens.com/#sle](http://www.usa.siemens.com/#sle).

#### 2.2 SWITCHBOARDS

- A. Provide switchboards consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Description: Dead-front switchboard assemblies complying with NEMA PB 2, and listed and labeled as complying with UL 891; ratings, configurations and features as indicated on the drawings.

- D. Service Entrance Switchboards:
  - 1. Listed and labeled as suitable for use as service equipment according to UL 869A.
  - 2. For solidly-grounded wye systems, provide factory-installed main bonding jumper between neutral and ground busses, and removable neutral disconnecting link for testing purposes.
  - 3. Comply with Utility Company requirements for electrical service.
- E. Switchboards With Fire Pump Taps: Provide separate bussed vertical section with suitable lugs for fire pump connection to line side of main service disconnect device(s).
- F. Service Conditions:
  - 1. Provide switchboards and associated components suitable for operation under the following service conditions without derating:
    - a. Altitude: Less than 6,600 feet ( 2,000 m ).
    - b. Ambient Temperature:
      - 1) Switchboards Containing Molded Case or Insulated Case Circuit Breakers: Between 23 degrees F ( -5 degrees C ) and 104 degrees F ( 40 degrees C ).
  - 2. Provide switchboards and associated components suitable for operation at indicated ratings under the service conditions at the installed location.
- G. Short Circuit Current Rating:
  - 1. Provide switchboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
- H. Main Devices: Configure for top or bottom incoming feed as indicated or as required for the installation. Provide separate pull section and/or top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.
- I. Bussing: Sized in accordance with UL 891 temperature rise requirements.
  - 1. Through bus (horizontal cross bus) to be fully rated through full length of switchboard (non-tapered). Tapered bus is not permitted.
  - 2. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
  - 3. Provide solidly bonded equipment ground bus through full length of switchboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
  - 4. Phase and Neutral Bus Material: Aluminum or copper.
  - 5. Ground Bus Material: Aluminum or copper.
- J. Conductor Terminations: Suitable for use with the conductors to be installed.
  - 1. Line Conductor Terminations:
    - a. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
    - b. Main and Neutral Lug Type: Mechanical.
  - 2. Load Conductor Terminations:
    - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
    - b. Lug Type:
      - 1) Provide mechanical lugs unless otherwise indicated.
- K. Enclosures:
  - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

- a. Indoor Clean, Dry Locations: Type 1 or Type 2 (drip-proof).
  - b. Outdoor Locations: Type 3R.
- 2. Finish: Manufacturer's standard unless otherwise indicated.
- 3. Outdoor Enclosures:
  - a. Color: Manufacturer's standard.
  - b. Access Doors: Lockable, with all locks keyed alike.
- L. Future Provisions:
  - 1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
- M. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 264300, list switchboards as a complete assembly including surge protective device.
- N. Instrument Transformers:
  - 1. Comply with IEEE C57.13.
  - 2. Select suitable ratio, burden, and accuracy as required for connected devices.
  - 3. Current Transformers: Connect secondaries to shorting terminal blocks.
  - 4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

## 2.3 OVERCURRENT PROTECTIVE DEVICES

- A. Circuit Breakers:
  - 1. Interrupting Capacity:
    - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
    - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
  - 2. Molded Case Circuit Breakers:
    - a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
    - b. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
    - c. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
    - d. Provide the following features and accessories where indicated or where required to complete installation:
      - 1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
  - 3. Insulated Case Circuit Breakers:
    - a. Description: Quick-make, quick-break, trip-free circuit breakers with two-step stored energy closing mechanism; standard 80 percent rated unless otherwise indicated; listed and labeled as complying with UL 489; ratings, configurations, and features as indicated.
    - b. Operation:
      - 1) Provide manually operated circuit breakers unless otherwise indicated.
      - 2) Provide electrically operated circuit breakers where indicated.

- c. Trip Units: Solid state, microprocessor-based, true rms sensing.

## 2.4 SOURCE QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Factory test switchboards according to NEMA PB 2, including the following production (routine) tests on each switchboard assembly or component:
  - 1. Dielectric tests.
  - 2. Mechanical operation tests.
  - 3. Grounding of instrument transformer cases test.
  - 4. Electrical operation and control wiring tests, including polarity and sequence tests.
  - 5. Ground-fault sensing equipment test.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install switchboards in accordance with NECA 1 (general workmanship), NECA 400, and NEMA PB 2.1.
- C. Arrange equipment to provide required clearances and maintenance access, including accommodations for any drawout devices.
- D. Where switchboard is indicated to be mounted with inaccessible side against wall, provide minimum clearance of 1/2 inch ( 10 mm ) between switchboard and wall.
- E. Provide required support and attachment in accordance with Section 260529.
- F. Install switchboards plumb and level.
- G. Unless otherwise indicated, mount switchboards on properly sized 4 inch ( 100 mm ) high concrete pad constructed in accordance with Section 033000.
- H. Provide grounding and bonding in accordance with Section 260526.
- I. Install all field-installed devices, components, and accessories.
- J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- K. Provide filler plates to cover unused spaces in switchboards.

### 3.2 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.
- C. Before energizing switchboard, perform insulation resistance testing in accordance with NECA 400 and NEMA PB 2.1.
- D. Inspect and test in accordance with NETA ATS, except Section 4.
- E. Perform inspections and tests listed in NETA ATS, Section 7.1.
- F. Molded Case and Insulated Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than [ ] amperes. Tests listed as optional are not required.
- G. Instrument Transformers: Perform inspections and tests listed in NETA ATS, Section 7.10. The dielectric withstand tests on primary windings with secondary windings connected to ground listed as optional are not required.
- H. Test shunt trips to verify proper operation.
- I. Correct deficiencies and replace damaged or defective switchboards or associated components.



### 3.3 CLEANING

- A. Clean dirt and debris from switchboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred surfaces to match original factory finish.

### 3.4 CLOSEOUT ACTIVITIES

- A. Training: Train Owner's personnel on operation, adjustment, and maintenance of switchboard and associated devices.
  - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

### 3.5 PROTECTION

- A. Protect installed switchboards from subsequent construction operations.

END OF SECTION

## SECTION 262416 - PANELBOARDS

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Power distribution panelboards.
- B. Lighting and appliance panelboards.
- C. Load centers.
- D. Overcurrent protective devices for panelboards.

## 1.2 RELATED REQUIREMENTS

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 260529 - Hangers and Supports for Electrical Systems.
- C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

## 1.3 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service 2013e (Amended 2017).
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NECA 407 - Standard for Installing and Maintaining Panelboards 2015.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2018.
- E. NEMA PB 1 - Panelboards 2011.
- F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less 2013.
- G. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems 2017.
- H. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- K. UL 67 - Panelboards Current Edition, Including All Revisions.
- L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.
- M. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.
- N. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.
- O. UL 1699 - Arc-Fault Circuit-Interrupters Current Edition, Including All Revisions.

## 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
  - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
  - 3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
  - 4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
  - 5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

## 1.5 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
  - 1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
  - 2. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.

## 1.6 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

## 1.8 FIELD CONDITIONS

- A. Maintain ambient temperature within the following limits during and after installation of panelboards:
  - 1. Panelboards Containing Circuit Breakers: Between 23 degrees F ( -5 degrees C ) and 104 degrees F ( 40 degrees C ).

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Eaton Corporation
- B. Schneider Electric; Square D Products
- C. Siemens Industry, Inc

### 2.2 PANELBOARDS - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
  - 1. Altitude: Less than 6,600 feet ( 2,000 m ).
  - 2. Ambient Temperature:
    - a. Panelboards Containing Circuit Breakers: Between 23 degrees F ( -5 degrees C ) and 104 degrees F ( 40 degrees C ).
- C. Short Circuit Current Rating:
  - 1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
  - 2. Listed series ratings are acceptable, except where not permitted by motor contribution according to NFPA 70.
  - 3. Label equipment utilizing series ratings as required by NFPA 70.
- D. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

- E. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- F. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- G. Bussing: Sized in accordance with UL 67 temperature rise requirements.
  - 1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
  - 2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
- H. Conductor Terminations: Suitable for use with the conductors to be installed.
- I. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
  - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: Type 1.
    - b. Outdoor Locations: Type 3R.
  - 2. Boxes: Galvanized steel unless otherwise indicated.
    - a. Provide wiring gutters sized to accommodate the conductors to be installed.
  - 3. Fronts:
    - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
    - b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
  - 4. Lockable Doors: All locks keyed alike unless otherwise indicated.
- J. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

## 2.3 POWER DISTRIBUTION PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:
  - 1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
  - 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
  - 1. Phase and Neutral Bus Material: Aluminum.
  - 2. Ground Bus Material: Aluminum.
- D. Circuit Breakers:
  - 1. Provide bolt-on type or plug-in type secured with locking mechanical restraints.
- E. Enclosures:
  - 1. Provide surface-mounted enclosures unless otherwise indicated.

## 2.4 LIGHTING AND APPLIANCE PANELBOARDS

- A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Conductor Terminations:

1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
  2. Main and Neutral Lug Type: Mechanical.
  - C. Bussing:
    1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
    2. Phase and Neutral Bus Material: Aluminum.
    3. Ground Bus Material: Aluminum.
  - D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.
  - E. Enclosures:
    1. Provide surface-mounted or flush-mounted enclosures as indicated.
    2. Provide clear plastic circuit directory holder mounted on inside of door.
- 2.5 LOAD CENTERS
- A. Description: Circuit breaker type load centers listed and labeled as complying with UL 67; ratings, configurations, and features as indicated on the drawings.
  - B. Bussing:
    1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
    2. Bus Material: Aluminum or copper.
  - C. Circuit Breakers: Thermal magnetic plug-in type.
  - D. Enclosures:
    1. Provide flush-mounted enclosures unless otherwise indicated.
    2. Provide circuit directory label on inside of door or individual circuit labels adjacent to circuit breakers.
- 2.6 OVERCURRENT PROTECTIVE DEVICES
- A. Molded Case Circuit Breakers:
    1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
    2. Interrupting Capacity:
      - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
      - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
      - c. Series Rated Systems: Provide circuit breakers listed in combination with upstream devices to provide interrupting rating not less than the short circuit current rating indicated.
    3. Conductor Terminations:
      - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
    4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
    5. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
    6. Provide the following circuit breaker types where indicated:
      - a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.

- b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
- c. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.
- 7. Do not use tandem circuit breakers.
- 8. Do not use handle ties in lieu of multi-pole circuit breakers.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.
- D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- E. Provide required support and attachment in accordance with Section 260529.
- F. Install panelboards plumb.
- G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.
- H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches ( 2000 mm ) above the floor or working platform.
- I. Provide minimum of six spare 1 inch ( 27 mm ) trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.
- J. Provide grounding and bonding in accordance with Section 260526.
- K. Install all field-installed branch devices, components, and accessories.
- L. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- M. Provide filler plates to cover unused spaces in panelboards.
- N. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads. Also provide for the following:
  - 1. Emergency and night lighting circuits.
  - 2. Fire detection and alarm circuits.
  - 3. Intrusion detection and access control system circuits.
  - 4. Video surveillance system circuits.
- O. Identify panelboards in accordance with Section 260553.

### 3.2 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than [ ] amperes. Tests listed as optional are not required.
- D. Test GFCI circuit breakers to verify proper operation.
- E. Test AFCI circuit breakers to verify proper operation.
- F. Correct deficiencies and replace damaged or defective panelboards or associated components.

### 3.3 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of panelboard fronts.

### 3.4 CLEANING

- A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

## SECTION 262726 - WIRING DEVICES

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Wall switches.
- B. Wall dimmers.
- C. Receptacles.
- D. Wall plates.
- E. Floor box service fittings.

## 1.2 RELATED REQUIREMENTS

- A. Section 260533.16 - Boxes for Electrical Systems.

## 1.3 REFERENCE STANDARDS

- A. FS W-C-596 - Connector, Electrical, Power, General Specification for 2017h.
- B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification) 2017g.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- D. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2010.
- E. NEMA WD 1 - General Color Requirements for Wiring Devices 1999 (Reaffirmed 2015).
- F. NEMA WD 6 - Wiring Devices - Dimensional Specifications 2016.
- G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 20 - General-Use Snap Switches Current Edition, Including All Revisions.
- I. UL 498 - Attachment Plugs and Receptacles Current Edition, Including All Revisions.
- J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices Current Edition, Including All Revisions.
- K. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.
- L. UL 1310 - Class 2 Power Units Current Edition, Including All Revisions.
- M. UL 1472 - Solid-State Dimming Controls Current Edition, Including All Revisions.

## 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
  - 2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
  - 3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
  - 4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
  - 5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

## 1.5 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

## 1.6 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.



## PART 2 PRODUCTS

### 2.1 WIRING DEVICE APPLICATIONS

- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
- B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
- C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.
- D. Provide tamper resistant receptacles for receptacles installed in dwelling units.
- E. Provide GFCI protection for receptacles installed within 6 feet ( 1.8 m ) of sinks.
- F. Provide GFCI protection for receptacles installed in kitchens.
- G. Provide GFCI protection for receptacles serving electric drinking fountains.
- H. Unless noted otherwise, do not use combination switch/receptacle devices.
- I. For flush floor service fittings, use tile rings for installations in tile floors.
- J. For flush floor service fittings, use carpet flanges for installations in carpeted floors.

### 2.2 WALL SWITCHES

- A. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
  - 1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

### 2.3 WALL DIMMERS

- A. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.

### 2.4 RECEPTACLES

- A. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
  - 1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
  - 2. NEMA configurations specified are according to NEMA WD 6.
- B. Convenience Receptacles:
  - 1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
  - 2. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
  - 3. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
- C. GFCI Receptacles:
  - 1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of

- protection; listed as complying with UL 943, class A.
- 2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
- 3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
- 4. Tamper Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.
- D. USB Charging Devices:
  - 1. USB Charging Devices - General Requirements: Listed as complying with UL 1310.

## 2.5 WALL PLATES

- A. Wall Plates: Comply with UL 514D.
  - 1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
  - 2. Size: Standard.
  - 3. Screws: Metal with slotted heads finished to match wall plate finish.

## 2.6 FLOOR BOX SERVICE FITTINGS

- A. Description: Service fittings compatible with floor boxes provided under Section 260533.16 with components, adapters, and trims required for complete installation.
- B. Flush Floor Service Fittings:
  - 1. Single Service Flush Convenience Receptacles:
    - a. Cover: Rectangular.
    - b. Configuration: One standard convenience duplex receptacle(s) with duplex flap opening(s).
  - 2. Single Service Flush Communications Outlets:
    - a. Cover: Rectangular.
    - b. Configuration: [\_\_\_\_\_].
    - c. Voice and Data Jacks: Provided by others.
  - 3. Dual Service Flush Combination Outlets:
    - a. Cover: Rectangular.
    - b. Configuration:
      - 1) Power: One standard convenience duplex receptacle(s) with duplex flap opening(s).
      - 2) Communications: [\_\_\_\_\_].
      - 3) Voice and Data Jacks: Provided by others.
  - 4. Accessories:
    - a. Tile Rings: Finish to match covers; configuration as required to accommodate specified covers.
    - b. Carpet Flanges: Finish to match covers; configuration as required to accommodate specified covers.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

### 3.2 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of wiring devices provided under this section.
  - 1. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
  - 2. Where multiple receptacles, wall switches or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
  - 3. Locate wall switches on strike side of door with edge of wall plate 3 inches ( 80 mm ) from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
  - 4. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.
- C. Install wiring devices in accordance with manufacturer's instructions.
- D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- E. Where required, connect wiring devices using pigtails not less than 6 inches ( 150 mm ) long. Do not connect more than one conductor to wiring device terminals.
- F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
- G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- H. Unless otherwise indicated, GFCI receptacles may be connected to provide feed-through protection to downstream devices. Label such devices to indicate they are protected by upstream GFCI protection.
- I. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- J. Install wall switches with OFF position down.
- K. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
- L. Do not share neutral conductor on branch circuits utilizing wall dimmers.
- M. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.
- N. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
- O. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

### 3.3 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect each wiring device for damage and defects.
- C. Operate each wall switch, wall dimmer and fan speed controller with circuit energized to verify proper operation.
- D. Test each receptacle to verify operation and proper polarity.

- E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
- F. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.4 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

3.5 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

**SECTION 264300 - SURGE PROTECTIVE DEVICES****PART 1 GENERAL****1.1 SECTION INCLUDES**

- A. Surge protective devices for service entrance locations.

**1.2 RELATED REQUIREMENTS**

- A. Section 260526 - Grounding and Bonding for Electrical Systems.
- B. Section 262413 - Switchboards.
- C. Section 262416 - Panelboards.

**1.3 REFERENCE STANDARDS**

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2018.
- C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. UL 1449 - Standard for Surge Protective Devices Current Edition, Including All Revisions.

**1.4 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.
- C. Shop Drawings: Include wiring diagrams showing all factory and field connections with wire and circuit breaker/fuse sizes.

**1.5 QUALITY ASSURANCE**

- A. Comply with requirements of NFPA 70.

**1.6 DELIVERY, STORAGE, AND PROTECTION**

- A. Store in a clean, dry space in accordance with manufacturer's written instructions.

**1.7 FIELD CONDITIONS**

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

**PART 2 PRODUCTS****2.1 SURGE PROTECTIVE DEVICES - GENERAL REQUIREMENTS**

- A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed, classified, and labeled as suitable for the purpose intended; system voltage as indicated on the drawings.
- B. Unless otherwise indicated, provide field-installed, externally-mounted or factory-installed, internally-mounted SPDs.
- C. List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.
- D. Protected Modes:
  - 1. Wye Systems: L-N, L-G, N-G, L-L.
- E. UL 1449 Voltage Protection Ratings (VPRs):
  - 1. 208Y/120V System Voltage: Not more than 1,000 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.

- F. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.
- G. Enclosure Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
- H. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.
  - 1. Switchboards: See Section 262413.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.
- C. Verify system grounding and bonding is in accordance with Section 260526, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.
- D. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.2 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- C. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 260526 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.

END OF SECTION

## SECTION 265100 - INTERIOR LIGHTING

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Interior luminaires.
- B. Emergency lighting units.
- C. Exit signs.
- D. Ballasts and drivers.
- E. Lamps.

## 1.2 RELATED REQUIREMENTS

- A. Section 260529 - Hangers and Supports for Electrical Systems.
- B. Section 260533.16 - Boxes for Electrical Systems.

## 1.3 REFERENCE STANDARDS

- A. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules 2015, with Errata (2017).
- B. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems 2006.
- C. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems 2006.
- D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 924 - Emergency Lighting and Power Equipment Current Edition, Including All Revisions.
- G. UL 1598 - Luminaires Current Edition, Including All Revisions.

## 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
  - 2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
  - 3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
  - 4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

## 1.5 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
  - 1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
  - 1. LED Luminaires:

- a. Include estimated useful life, calculated based on IES LM-80 test data.
- 2. Lamps: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.

#### 1.6 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

#### 1.7 DELIVERY, STORAGE, AND PROTECTION

- A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting) and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

### PART 2 PRODUCTS

#### 2.1 LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.

#### 2.2 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.
- D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.
- F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

#### 2.3 EMERGENCY LIGHTING UNITS

- A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
- B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
- C. Battery:
  - 1. Size battery to supply all connected lamps, including emergency remote heads where indicated.
- D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
- E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

#### 2.4 EXIT SIGNS

- A. Description: Internally illuminated exit signs with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
  - 1. Number of Faces: Single or double as indicated or as required for the installed location.
  - 2. Directional Arrows: As indicated or as required for the installed location.



## 2.5 BALLASTS AND DRIVERS

### A. Ballasts/Drivers - General Requirements:

1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

### B. Dimmable LED Drivers:

1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
2. Control Compatibility: Fully compatible with the dimming controls to be installed.

## 2.6 LAMPS

### A. Lamps - General Requirements:

1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of luminaires provided under this section.
- B. Install products in accordance with manufacturer's instructions.
- C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).
- D. Provide required support and attachment in accordance with Section 260529.
- E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- F. Suspended Ceiling Mounted Luminaires:
  1. Do not use ceiling tiles to bear weight of luminaires.
  2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
  3. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
  4. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.
- G. Recessed Luminaires:
  1. Install trims tight to mounting surface with no visible light leakage.
  2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
  3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
- H. Suspended Luminaires:

1. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
  - I. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
  - J. Install accessories furnished with each luminaire.
  - K. Bond products and metal accessories to branch circuit equipment grounding conductor.
  - L. Emergency Lighting Units:
    1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
  - M. Exit Signs:
    1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
  - N. Install lamps in each luminaire.
- 3.2 FIELD QUALITY CONTROL
- A. See Section 014000 - Quality Requirements, for additional requirements.
  - B. Inspect each product for damage and defects.
  - C. Operate each luminaire after installation and connection to verify proper operation.
  - D. Test self-powered exit signs, emergency lighting units and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.
  - E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.
- 3.3 ADJUSTING
- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.
  - B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.
  - C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.
- 3.4 CLEANING
- A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting) and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.
- 3.5 CLOSEOUT ACTIVITIES
- A. Demonstration: Demonstrate proper operation of luminaires to Architect, and correct deficiencies or make adjustments as directed.
- 3.6 PROTECTION
- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

## Section 276000-Emergency Responder Radio Responder Coverage System (ERRCS)

## PART 1 GENERAL

## 1.1 SUMMARY

- A. Furnish, install, and test a complete and operating Emergency Responder Radio Antenna/Repeater System. The system will support the Fulton County public safety radio system only and no others including but not limited to. other public safety systems (e.g. police); cell phone carriers; the Owners' private security and/or maintenance personnel radio systems, etc. – now or in the future – shall not be included.
- B. This Section includes the requirements for an Emergency Responder Radio Antenna/Repeater System for the purposes of amplifying Emergency Responder radio signals of the Authority Having Jurisdictions (AHJ) public safety radio communication system (Fulton County )to achieve minimum signal strength in 95% of all areas on each floor of the building and 99% coverage in critical areas as defined by IFC Section 510 and the AHJ adopted modifications.
- C. Final acceptance and approval is required from the local Fire Department or AHJ in writing prior to contract closeout.
- D. Coordinate testing with the Fire Marshal Testing and Commissioning: Coordinate the completion date of the Fire Department and radio signal repeater system so as to permit a Certificate of Occupancy to be obtained in a timely manner, in accordance with a schedule established by the Owner's Project Manager and the Authority Having Jurisdiction (AHJ)
- E. Section Includes
  - 1. Bi-directional amplifiers (BDA's)
  - 2. Distributed Antenna System
  - 3. Coaxial cables
  - 4. Splitters and direction couplers
  - 5. All other equipment and components necessary for a complete and functioning Emergency Responder Radio Antenna/Repeater System.

## 1.2 REGULATIONS

- A. Codes, regulations and standards referenced in the Section are:
  - 1. NFPA 1 – The National Fire Code (including Annex O from 2009)
  - 2. NFPA 70 – The National Electrical Code
  - 3. International Fire Code (IFC) Section 510 2012
  - 4. Authority Having Jurisdiction (AHJ) adopted modifications

## 1.3 DEFINITIONS

- A. Definitions:
  - 1. Bi-Directional Amplifier BDA: Device used to amplify band-selective or multi-band RF signals in the uplink, to the base station for enhanced signals and

- improved coverage.
2. Emergency Responder Radio Coverage System: A two-way radio communication System installed to assure the effective operation of radio communications systems for fire, emergency medical services or law enforcement agencies within a building or structure. A system used by firefighters, police, and other emergency services personnel.
  3. FCC: Federal Communications Commission
  4. OET 65 Standards: FCC's Bulletin 65 provides Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.
  5. Public Safety/First Responder: Public Safety or First Responder agencies which are charged with the responsibility of responding to emergency situations. These include, but are not limited to: law enforcement departments, fire departments, and emergency medical companies.
  6. AHJ: Authority Having Jurisdiction
  7. dBm: The power ratio in decibels (dB) of the measured power referenced to one milliwatt (mW) a measurement of absolute power.

#### 1.4 ACTION SUBMITTALS

- A. Submit product data for each type of proposed system component specified, including dimensioned drawings showing minimum clearances and installed features.
- B. Layout Drawings
  1. Component specification sheets shall be 8.5 inch x 11 inch or greater, scaled or dimensioned, with dimensions or scale clearly noted.
  2. Floor plan drawings shall be 24 inch x 36 inch minimum with drawings scaled to legible size.
  3. Floor plan drawings may include elevation detail names for each elevation view. Sheet title shall include site name, address, sheet number, floor plan number and north arrow. Include site plan view of the subject buildings and surrounding property to clearly indicate the location and orientation of roof mounted outdoor antennas associated with the proposed system.
  4. Include a minimum of (1) building elevation depicting the location of any outdoor antennas associated with the proposed system. Include height of antenna centerline above building, orientation, and location of all external grounding connections. Include a detail plan view of all Telecommunications Spaces housing head-end and/or other consolidated equipment, showing the location of the rack(s) and/or enclosure(s) of the Emergency Responder Radio Antenna/Repeater System equipment.
  5. Include a separate plan view of each interior floor where indoor antenna systems are proposed. Include antenna numbers, coaxial cable routes, and the locations of any other system components including splitters, couplers, filters, amplifiers, etc. All components shall be named or labeled for reference in power budget calculations tables. Overlay approximated coverage radii indicating -95 dBm downlink (base to mobile) signal strength around each proposed indoor coverage antenna. Include results of any previous coverage testing per grid, if available.
  6. Include a minimum of one (1) detail elevation view(s) of all rack(s) and/or

enclosure(s) housing the Emergency Responder Radio Antenna/Repeater System equipment. Identify each piece of equipment by brand, model number and equipment type (e.g. Acme BA123 RF amplifier).

7. Specify antenna grounding and surge protection in accordance with NEC Article 810.
8. Specify the backup power source (Life Safety), and include calculations to ensure the backup power requirements as specified in IFC Section 510.4.2.3
9. Shop Drawings: Provide a complete, detailed floor plans and one-line installation diagram showing all equipment, devices and the required interconnections of each component. Indicate dimensions and components for each device that is not a standard product of the manufacturer.
10. Product Data: Provide a complete bill of materials and accompanying product data sheets for each component. Data sheets shall indicate dimensions, ratings, performance data and UL Listing information for each component. Specific items being proposed shall be highlighted or noted on each sheet.
11. Design Data: Include signal calculations.
12. Test Reports: Indicate measured signal levels during both pre-installation and predictive signal levels post-installation.
13. Filings: The System Design Engineer shall provide all necessary documents required by the AHJ and Contractor for submitting to the Fire Department, their Communications Division, and any other agencies having jurisdiction.
14. Necessary documents shall include but not be limited to the required quantities of floor plans, system narrative, system specifications, wiring diagrams, shop drawings and any aforementioned documents requiring the System Designers signature.

C. Equipment Specification Sheets

Provide copies of manufacturer specification sheets of all system components, including:

- a. Bi-directional radio amplifiers
- b. Battery Back-up
- c. Distributed Antenna System (DAS)
- d. Coaxial cable (Plenum Rated)
- e. Antennas
- f. Terminators
- g. T-taps
- h. Lightning Suppression
- i. Other components, hardware and interconnecting circuitry as specified and required. Couplers, splitters, combiners, or other passive components

D. Operation and maintenance data

1. Pass band curves in for the uplink and downlink portions of the NPSPAC band for any amplifiers, if not included in #1. Amplifiers may NOT amplify portions of other licensed services, including Nextel and Specialized Mobile Radio Licensee band, or Cellular A or B bands.
2. The input and output pass band of the system amplifier(s) shall have a center frequency as required to accommodate the local Fire Department's operating channels.

3. Backup battery and charging system.
- E. Submit wiring diagrams from manufacturer differentiating clearly between factory and field-installed wiring. Include diagrams for each component of the system with all terminals and interconnections identified. Make all diagrams specific to this Project.
- F. Submit product certificates signed by the manufacturer of radio system components certifying that their products comply with specified requirements IFC Sections 510.4.2.1 through 510.4.2.5 and any AHJ adopted modifications.
- G. Submit agenda for training class and copies of all handouts for the class.
- H. Maintenance data for radio system shall be included in the operation and maintenance manual. Include data for each type of product, including all features and operating sequences, both automatic and manual. Provide the names, addresses, and telephone numbers of service organizations that carry stock of repair parts for the system to be furnished.
- I. Record of field tests of the radio system shall be included in the operation and maintenance manuals.
- J. Design Approval: Plans shall be submitted and approved prior to installation. The following information shall be provided to the local Fire Department unit representative by the system designer/Contractor:
  1. A minimum of three (3) copies of detailed drawings showing the location of the amplification equipment and associated antenna systems which includes a view showing building access to the equipment.
  2. A minimum of three (3) copies of schematic drawings of the electrical system, backup power, antenna system and any other associated equipment relative to the amplification equipment including panel locations and labeling.
  3. A minimum of one (1) copy of the Manufacturer's data sheets on all equipment to be installed.
  4. Copy of FCC license of the lead system designer and Lead Installer. IFC Section 510.5.2 & Fulton Counties adopted modifications
  5. Copy of Low voltage license. IFC Section 510.3 & Fulton Counties adopted modifications
  6. See Attachment "A"

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced factory-authorized installer to perform work of this Section.
- B. Single-Source Responsibility: Obtain radio system components from a single source who assumes responsibility for compatibility of system components.
- C. All equipment shall be UL listed and labeled, and in accordance with applicable NEMA and ANSI Standards. Where copper cabling is routed to an area, either in another building, or with a separate electrical service, the Technology Contractor

shall provide primary protective equipment.

- D. All racks and enclosures shall be either welded or assembled with paint piercing ground washers, grounding strip and bonding jumper as indicated on the Drawings.
- E. The Lead Field Installer shall have a valid FCC License. IFC Section 510.5.2 and Fulton County's adopted Modifications

## 1.6 MANUFACTURERS

- A. Subject to compliance with requirements, available Integrators offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. CommScope/Andrew
  - 2. Corning
  - 3. Times Microwave
  - 4. Tessco
  - 5. Solid Technologies
  - 6. Comba
  - 7. Talley
  - 8. ADRF
  - 9. Accu-Tech
  - 10. Bird Technologies
  - 11. GrayBar
  - 12. Diversified Electronics inc.

## PART 2 PRODUCTS

### 2.1 GENERAL PERFORMANCE REQUIREMENTS

- A. Compatibility: The equipment, including but not limited to repeaters, transmitters, receivers, signal boosters, cabling, fiber distributed antenna system, etc., shall not interfere with the existing communication systems utilized by the Public Safety and First Responder agencies.
- B. Power Supplies: At least two (2) independent and reliable power supplies shall be provided, one primary and one secondary. The primary power source shall be supplied from a dedicated 20 ampere branch circuit. The secondary power supply shall be capable of operating the emergency responder radio coverage system for a period of at least 24 hours in accordance with IFC Section 510.4.2.3. When primary power is lost, the power supply to the emergency responder radio coverage system shall automatically transfer to the secondary power supply. The secondary power source shall be a dedicated battery, capable of operating the in-building radio system for at least 24 hours of 100% system operation. The battery system shall automatically charge in the presence of external power input. The battery system shall be contained in one NEMA 4 or 4X type enclosures. Monitoring the integrity of power supplies shall be in accordance with IFC Section 510.4.2.3

C. Survivability

1. Fire Performance: All main risers or trunks of the antenna system shall be installed with resistance to attack from a fire using one of the following methods:
  - a. A -Fire rated cable or cable system.
  - b. When routing the cable through a fire rated enclosure(s), walls, rooms or shaft(s) The fire rating shall be maintained.
  - c. Performance alternative approved by the State Fire Marshal.
  - d.
2. Cabinet: The signal booster and all associated RF filters shall be housed in a single, NEMA 4 certified, painted steel weather tight box. The cabinet shall be large enough to dissipate internal heat without venting the inside of the cabinet to the outside atmosphere. Operating temperatures: –22 degrees F to +120 degrees F (–30 degrees C to +50 degrees C) minimum temperature range, including microprocessors. Equipment installed on the roof of structures shall be rated for the expected extreme temperatures associated with rooftop installations.
3. Passive Equipment: Passband shall be designed to support the Public Safety communication system of the AHJ.
4. Cable: Passband shall be designed to support the Public Safety communication system of the AHJ. Cable shall be rated for fire plenum and riser rating.

D. Radio signal strength.

The building shall be considered to have acceptable emergency responder radio coverage when signal strength measurements in 95 percent of all areas on each floor of the building meet the signal strength requirements in IFC Sections 510.4.1.1 and 510.4.1.2. .

E. Minimum signal strength into the building.

A minimum signal strength of -95 dBm shall be receivable within the building.

F. Minimum signal strength out of the building.

A minimum signal strength of -95 dBm shall be received by the agency's radio system when transmitted from within the building.

G. All critical areas -as defined in NFPA 72- SHALL BE COVERED WITH A MINIMUM OF -95dBm, show anticipated signal coverage in each area for talk-in and talk-out.

H. Secondary power.

Emergency responder radio coverage systems shall be provided with an approved secondary source of power. The secondary power supply shall be capable of operating the emergency responder radio coverage system for a period of at least 24 hours. When primary power is lost, the power supply to the emergency responder radio coverage system shall automatically transfer to the secondary power supply.

I. Signal booster requirements.

If used, signal boosters shall meet the following requirements:

1. All signal booster components shall be contained in a National Electrical Manufacturer's Association (NEMA) 4-type waterproof cabinet.
2. Battery systems used for the emergency power source shall be contained in a NEMA 4-type waterproof cabinet.
3. The signal booster system and battery system shall be electrically supervised and monitored by a supervisory service, or when approved by



the fire code official, shall sound an audible signal at a constantly attended location.

4. Equipment shall have FCC certification prior to installation.

J. Minimum qualifications of personnel.

The minimum qualifications of the system designer and lead installation personnel shall include:

1. A valid FCC-issued general radio operator's license
2. Certification of in-building system training issued by a nationally recognized organization, school or a certificate issued by the manufacturer of the equipment being installed.
3. Trained and certified on any Software used to design the system

K. Testing and proof of compliance.

The emergency responder radio coverage system shall be inspected and tested annually or whenever structural changes occur including additions or remodels that could materially change the original field performance tests.

Testing shall consist of the following:

1. In-building coverage test as described in Section 510.5.3. of IFC.
2. Signal boosters shall be tested to ensure that the gain is the same as it was upon initial installation and acceptance.
3. Backup batteries and power supplies shall be tested under load of a period of one hour to verify that they will properly operate during an actual power outage. If within the 1-hour test period the battery exhibits symptoms of failure, the test shall be extended for additional 1-hour periods until the integrity of the battery can be determined.
4. All other active components shall be checked to verify operation within the manufacturer's specifications.

## 2.2 SYSTEM COMPONENTS

A. Signal Strength

1. Downlink: A minimum signal strength of -95 dBm shall be provided throughout the coverage area.
2. Uplink: Minimum signal strength of -95 dBm received at the local Fire Department Radio System from the coverage area.
3. A donor antenna must maintain isolation from the distributed antenna system. The donor antenna signal level shall be a minimum of 15 dB above the distributed antenna system under all operating conditions.

B. Permissible Systems

1. Buildings and structures shall be equipped with an FCC Certificated Class "A" Bi-Directional Amplifier(s) as needed.
2. The distributed antenna system may utilize a radiating cable, fixed antennas or a combination of both.

C. Supported Frequencies:

The radio system shall support frequencies of the AHJ public safety bands.

D. Reject Filters:

Notch filter sections shall be incorporated to minimize adjacent channel cellular and SMR (Nextel) degradation of the signal booster performance. The minimum downlink band adjacent band rejection shall be 35 dB or greater at 865 MHz and 870 MHz.

E. Band Migration Capability:

The signal booster shall include re-tunable or replaceable filters to accommodate rapid and economic passband changes in the event of mandatory FCC changes within the Public Safety band. The use of non-adjustable and non-replaceable RF input and output filters is prohibited.

F. Output Level Control:

An automatic output leveling circuit shall be included for both passbands with a minimum dynamic range of 60 dB, less any gain reduction setting, to maintain FCC out of band and spurious emission compliance.

G. Mode of Operation:

The system shall be normally powered on and shall continuously provide passing of frequencies within the Public Safety and First Responder bands.

H. All in-building radio systems shall be compatible with both analog and digital communications simultaneously at the time of installation.

## 2.3 SYSTEM MONITORING

- A. The distributed antenna system shall include a connection to the fire alarm system to monitor the integrity of the circuit of the signal booster(s) and power supplies and annunciate this malfunction on the fire alarm system and shall comply with IFC section 510.4.2.3
- B. A sign shall be located at the fire alarm panel with the name and telephone number of the local Fire Department indicating that they shall be notified of any failures that extend past the 2 hour time limit.

## PART 3 EXECUTION

### 3.1 INSTALLATION

A. Distribution System Signal Wires and Cables

1. Wires and cables shall enter each equipment enclosure, console, cabinet or rack in such a manner that all doors or access panels can be opened and closed without removal or disruption of the cables.
2. Routing and Interconnection
  - a) Wires or cables routed between consoles, cabinets, racks, and other equipment shall be installed in an approved conduit or cable tray that is secured to building structure.

- b) Completely test all of the cables after installation and replace any that are found to be defective.
- c) Install cables without damaging conductors, shield, or jacket.
- d) Do not bend cables, while handling or installing, to radii smaller than as recommended by manufacturer.
- e) Pull cables without exceeding cable manufacturer's recommended pulling tensions.

B. Product Delivery, Storage, and Handling

- 1. Delivery: Deliver materials to the job site in OEM's original unopened containers, clearly labeled with the OEM's name and equipment model and serial identification numbers.
- 2. Store and protect equipment in a conditioned space until installation.

C. System Installation

- 1. Coaxial antenna cabling shall not be installed in the same conduit, raceway, or cable trays used for other systems.
- 2. All equipment shall be connected according to the OEM's specifications to insure correct installation and system performance.
- 3. Coordinate all roof penetrations with Owner and/or roofing contractor.

### 3.2 LICENSING

- A. All fees associated with the licensing shall be paid by the Contractor.
- B. All testing must be done on frequencies authorized by the AHJ Approved certification testing vendor.
- C. Low voltage Installation license required

### 3.3 GROUNDING

- A. Ground cable shields and equipment per Manufacturer's requirements.
- B. Antenna mast shall be grounded per NFPA 70 NEC requirements, Section 27 05 26, "Grounding and Bonding for Communications Systems" and antenna manufacturer's requirements. Provide grounding blocks and surge protection for outside coaxial cabling. Bond the antenna mast to the building steel.

### 3.4 APPROVAL TESTING

- A. The local Fire Marshals office will review plans and specifications. (See Attachment "A") Upon acceptance, plans will be stamped to indicate approval. Stamped plans are required to be present at the acceptance test. Any field changes that occur during construction shall be incorporated into new As-Built plans, including any manufacturer's data sheets for any equipment changes not submitted in the original submittal. As-Built plans, if required due to system changes, shall be submitted to the local Fire Marshal's office for approval.
- B. Tests shall be made using frequencies close to the frequencies used by the Fire Department and appropriate emergency services. If testing is done on the actual frequencies, then this testing must be coordinated with the local Fire Department

unit. All testing must be done on frequencies authorized by the FCC. A valid FCC license will be required if testing is done on frequencies different from the police, fire or emergency medical frequencies.

C. Testing Procedures

1. Minimum Signal Strength: For testing system signal strength and quality, the testing shall be performed in accordance with IFC section 510.5.3
2. Each floor of the building shall be divided into a grid of 20 approximately equal test areas. (See Attachment 'B')
3. The test shall be conducted using a calibrated portable Radio of the latest brand and model used by the agency talking through the agency's radio communications system.
4. A test location approximately in the center of each test area shall be selected for the test, with the radio enabled to verify two-way communications to and from the outside of the building through the public agency's radio communications system. Once the test location has been selected, that location shall represent the entire test area. Failure in the selected test location shall be considered failure of that test area. Additional test locations shall not be permitted.
5. The gain values of all amplifiers shall be measured and the test measurement results shall be kept on file with the building owner so that the measurements can be verified during annual tests. In the event that the measurement results become lost, the building owner shall be required to rerun the acceptance test to re-establish the gain values.
6. As part of the installation a spectrum analyzer or other suitable test equipment shall be utilized to ensure spurious oscillations are not being generated by the subject signal booster. This test shall be conducted at time of installation and subsequent annual inspections.
7. Measurements shall be made with the antenna held in a vertical position at 3 to 4 feet above the floor to simulate a typical portable radio worn on the belt or turnout coat pocket.

D. Final Acceptance Testing

1. All acceptance testing shall be done by the AHJs' approved certification testing vendor. (See Attachment "D") at no expense to the AHJ.
2. Small scale drawings (11 inch x 17 inch maximum) of the structure shall be provided by to testing Contractor. The plans shall show each floor divided into the grids as approved by the Fire Marshal's Office described above. The results of the post-testing each grid shall be labeled to indicate the Pass or Failure based on the dBm result from the final acceptance testing.
3. The Testing vendor shall provide the latest approved post-testing results to the owner and Fire marshal's office upon completion, with a certification letter of compliance for the system.
4. Include testing results of the repeater (output wattage, gain level, etc.) and connection to the fire alarm.

3.5 MAINTENANCE AND ANNUAL TESTING

- A. Annual tests will be conducted by the AHJ Approved Certification Testing vendor. (See Attachment "D")

1. The re-testing will be done at no expense to the County or the appropriate emergency services departments as required in the original testing procedures.
- B. A signed owner's acknowledgement is required on the certificate of completion document required by the AHJ. (See Attachment "E")
- C. Maintenance Contract
  1. Maintenance contract with a Radio Service Provider in place with name of authorized company, who will provide a 24 hour by 7 day emergency response within two (2) hours after notification. The system shall be maintained in accordance with FCC requirements. The contract shall be for 5 years.
  2. All tests shall be conducted, documented, and signed by a person in possession of a current FCC General Radio telephone Operator License, or a technician certification issued by the Association of Public-Safety Communications Officials International (APCO) or equivalent as determined by the local AHJ.
  3. Maintain a list of contact personnel with phone numbers at the radio repeater system cabinet. The contact personnel shall have knowledge of the building and the repeater system and be available to respond to the building in the case of an emergency.
  4. Radio Service Provider maintenance contract shall include but not limited to:
    - a. AnnualTest
      - 1) All active components of the distributed antenna system, including but not limited to amplifier, power supplies, and back-up batteries, shall be tested a minimum of once every 12 months.
      - 2) Amplifiers shall be tested to insure that the gain is the same as it was upon initial installation and acceptance. The original gain shall be noted and any change in gain shall be documented.
      - 3) Back-up batteries and power supplies shall be tested under load for a period of 1 hour to verify that they will operate during an actual power outage.
      - 4) Active components shall be checked to determine that they are operating within the manufacturer's specifications for their intended purpose.
      - 5) Documentation of the test shall be maintained on site and a copy forwarded to the local Fire Marshal Office upon completion of the test.
  5. Fire Department Radio personnel, after providing reasonable notice to the Owner or their representative, shall have the right to enter onto the property to conduct field testing to be certain that the required level of radio

END OF SECTION 276000

## SECTION 284600 - FIRE DETECTION AND ALARM

## PART 1 GENERAL

## 1.1 SECTION INCLUDES

- A. Fire alarm system design and installation, including all components, wiring, and conduit.
- B. Transmitters for communication with supervising station.
- C. Circuits from protected premises to supervising station, including conduit.

## 1.2 RELATED REQUIREMENTS

- A. Section 142100 - Electric Traction Elevators: Elevator systems monitored and controlled by fire alarm system.
- B. Section 142400 - Hydraulic Elevators: Elevator systems monitored and controlled by fire alarm system.
- C. Section 149100 - Facility Chutes: Sensors and interlocks monitored by fire alarm system.
- D. Section 211300 - Fire-Suppression Sprinkler Systems: Supervisory, alarm, and actuating devices installed in sprinkler system.
- E. Section 213000 - Fire Pumps: Supervisory devices.
- F. Section 233300 - Air Duct Accessories: Smoke dampers monitored and controlled by fire alarm system.

## 1.3 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design 2010.
- C. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits 2002 (Corrigendum 2012).
- D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. NFPA 72 - National Fire Alarm and Signaling Code Most Recent Edition Cited by Referring Code or Reference Standard.
- F. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

## 1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Evidence of designer qualifications.
- C. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
  - 1. Copy (if any) of list of data required by authority having jurisdiction.
  - 2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
  - 3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
  - 4. System zone boundaries and interfaces to fire safety systems.
  - 5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
  - 6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage

- drop calculations.
- 7. List of all devices on each signaling line circuit, with spare capacity indicated.
- 8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
- 9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
- 10. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
- 11. Certification by the manufacturer of the control unit that the system design complies with Contract Documents.
- 12. Certification by Contractor that the system design complies with Contract Documents.
- D. Evidence of installer qualifications.
- E. Evidence of maintenance contractor qualifications, if different from installer.
- F. Inspection and Test Reports:
  - 1. Submit inspection and test plan prior to closeout demonstration.
  - 2. Submit documentation of satisfactory inspections and tests.
  - 3. Submit NFPA 72 "Inspection and Test Form," filled out.
- G. Operating and Maintenance Data: See Section 017800 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
  - 1. Complete set of specified design documents, as approved by authority having jurisdiction.
  - 2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
  - 3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
  - 4. List of recommended spare parts, tools, and instruments for testing.
  - 5. Replacement parts list with current prices, and source of supply.
  - 6. Detailed troubleshooting guide and large scale input/output matrix.
  - 7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
  - 8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.
- H. Project Record Documents: See Section 017800 for additional requirements; have one set available during closeout demonstration:
  - 1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
  - 2. "As installed" wiring and schematic diagrams, with final terminal identifications.
  - 3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.
- I. Closeout Documents:
  - 1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.

2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.

## 1.5 QUALITY ASSURANCE

- A. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer, with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.
- B. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
  1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
  2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
  3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.
- C. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Fire Alarm Control Units and Accessories - Other Acceptable Manufacturers:
  1. Honeywell Security & Fire Solutions/Gamewell-FCI; [\_\_\_\_]: [www.gamewell-fci.com/#sle](http://www.gamewell-fci.com/#sle).
  2. Honeywell Security & Fire Solutions/Fire-Lite; [\_\_\_\_]: [www.firelite.com/#sle](http://www.firelite.com/#sle).
  3. Honeywell Security & Fire Solutions/Notifier; [\_\_\_\_]: [www.notifier.com/#sle](http://www.notifier.com/#sle).
  4. Honeywell Security & Fire Solutions/Silent Knight; [\_\_\_\_]: [www.silentknight.com/#sle](http://www.silentknight.com/#sle).
  5. Honeywell Security & Fire Solutions/Vista; [\_\_\_\_]: [www.security.honeywell.com/#sle](http://www.security.honeywell.com/#sle).
  6. Siemens Building Technologies, Inc; [\_\_\_\_]: [www.usa.siemens.com/#sle](http://www.usa.siemens.com/#sle).
  7. Simplex, a Tyco Business; [\_\_\_\_]: [www.simplex-fire.com/#sle](http://www.simplex-fire.com/#sle).
  8. Provide control units made by the same manufacturer.
- B. Initiating Devices and Notification Appliances:
  1. Same manufacturer as control units.
- C. Substitutions: See Section 016000 - Product Requirements.
  1. For other acceptable manufacturers of control units specified, submit product data showing equivalent features and compliance with Contract Documents.
  2. For substitution of products by manufacturers not listed, submit product data showing features and certification by Contractor that the design will comply with Contract Documents.

### 2.2 FIRE ALARM SYSTEM

- A. Fire Alarm System: Provide a new automatic fire detection and alarm system:
  1. Provide all components necessary, regardless of whether shown in Contract Documents or not.
  2. Protected Premises: Entire building shown on drawings.
  3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
    - a. ADA Standards.



- b. The requirements of the State Fire Marshal.
    - c. The requirements of the local authority having jurisdiction .
    - d. Applicable local codes.
    - e. Contract Documents (drawings and specifications).
    - f. NFPA 101.
    - g. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
  - 4. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.
  - 5. Voice Notification: Provide emergency voice/alarm communications with multichannel capability; digital.
  - 6. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
  - 7. Program notification zones and voice messages as directed by Owner.
  - 8. Hearing Impaired Occupants: Provide visible notification devices in all public areas and in dwelling units.
  - 9. Fire Command Center: Located in on-premises supervising station.
  - 10. Fire Alarm Control Unit.
  - 11. Two-Way Telephone: Provide two-way telephone service for the use of the fire service and others; provide jacks and two portable handsets.
  - B. Supervising Stations and Fire Department Connections:
    - 1. Public Fire Department Notification: By on-premises supervising station.
    - 2. On-Premises Supervising Station: New proprietary station operated by Owner.
    - 3. Means of Transmission to On-Premises Supervising Station: Directly connected noncoded system.
  - C. Circuits:
    - 1. Initiating Device Circuits (IDC): Class B, Style A.
    - 2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.
    - 3. Signaling Line Circuits (SLC) Between Buildings: Class A, Style 2.
    - 4. Notification Appliance Circuits (NAC): Class B, Style W.
  - D. Power Sources:
    - 1. Primary: Dedicated branch circuits of the facility power distribution system.
    - 2. Secondary: Storage batteries.
    - 3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
    - 4. Each Computer System: Provide uninterruptible power supply (UPS).
- 2.3 FIRE SAFETY SYSTEMS INTERFACES
- A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
    - 1. Sprinkler water control valves.
    - 2. Dry-pipe sprinkler system pressure.
    - 3. Dry-pipe sprinkler valve room low temperature.
    - 4. Fire pump(s).
    - 5. Elevator shut-down control circuits.
  - B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
    - 1. Sprinkler water flow.

2. Elevator lobby, elevator hoistway, and elevator machine room smoke detectors.
3. Duct smoke detectors.
- C. Elevators:
  1. Elevator lobby, hoistway, and machine room smoke detectors: Elevator recall for fire fighters' service.
  2. Elevator Machine Room Heat Detector: Shut down elevator power prior to hoistway sprinkler activation.
  3. Sprinkler pressure or waterflow: Shut down elevator power prior to hoistway sprinkler activation.
- D. HVAC:
  1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.

## 2.4 COMPONENTS

- A. General:
  1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
  2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.
- B. Fire Alarm Control Units: Analog, addressable type; listed, classified, and labeled as suitable for the purpose intended.
- C. Master Control Unit: As specified for Basis of Design above, or equivalent.
- D. Initiating Devices:
  1. Addressable Systems:
    - a. Addressable Devices: Individually identifiable by addressable fire alarm control unit.
    - b. Provide suitable addressable interface modules as indicated or as required for connection to conventional (non-addressable) devices and other components that provide a dry closure output.
  2. Manual Pull Stations: [\_\_\_\_\_].
  3. Smoke Detectors: [\_\_\_\_\_].
  4. Duct Smoke Detectors: [\_\_\_\_\_].
  5. Heat Detectors: [\_\_\_\_\_].
- E. Notification Appliances:
  1. Speakers: [\_\_\_\_\_].
  2. Strobes: [\_\_\_\_\_].
- F. Circuit Conductors: Copper or optical fiber; provide 200 feet ( 60 m ) extra; color code and label.
- G. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.
- H. Locks and Keys: Deliver keys to Owner.
- I. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
  1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
  2. Provide one for each control unit where operations are to be performed.
  3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
  4. Provide extra copy with operation and maintenance data submittal.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and Contract Documents.
- B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.
- C. Obtain Owner's approval of locations of devices, before installation.
- D. Install instruction cards and labels.

### 3.2 INSPECTION AND TESTING FOR COMPLETION

- A. Notify Owner 7 days prior to beginning completion inspections and tests.
- B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.
- D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.
- E. Provide all tools, software, and supplies required to accomplish inspection and testing.
- F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.
- G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.
- H. Diagnostic Period: After successful completion of inspections and tests, Operate system in normal mode for at least 14 days without any system or equipment malfunctions.
  - 1. Record all system operations and malfunctions.
  - 2. If a malfunction occurs, start diagnostic period over after correction of malfunction.
  - 3. Owner will provide attendant operator personnel during diagnostic period; schedule training to allow Owner personnel to perform normal duties.
  - 4. At end of successful diagnostic period, fill out and submit NFPA 72 "Inspection and Testing Form."

### 3.3 CLOSEOUT

- A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
  - 1. Be prepared to conduct any of the required tests.
  - 2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
  - 3. Have authorized technical representative of control unit manufacturer present during demonstration.
  - 4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
  - 5. Repeat demonstration until successful.

### 3.4 MAINTENANCE

- A. See Section 017000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.
- B. Provide to Owner, a proposal as an alternate to the base bid, for a maintenance contract for entire warranty period, to include the work described below; include the total cost of contract, proposal to be valid at least until 30 days after date of

## Substantial Completion.

- C. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
  - 1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
  - 2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
  - 3. Record keeping required by NFPA 72 and authorities having jurisdiction.
- D. Provide trouble call-back service upon notification by Owner:
  - 1. Provide on-site response within 2 hours of notification.
  - 2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
  - 3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.
- E. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.
- F. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.
- G. Comply with Owner's requirements for access to facility and security.

END OF SECTION

## SECTION 313116 - TERMITE CONTROL

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

## 1.2 SUMMARY

- A. Section Includes:

- 1. Soil treatment.

- B. Related Requirements:

- 1. Section 061000 "Rough Carpentry" for wood preservative treatment by pressure process.
  - 2. Section 076200 "Sheet Metal Flashing and Trim" for custom-fabricated, metal termite shields.

## 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

## 1.4 ACTION SUBMITTALS

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

- 1. Include construction details, material descriptions, dimensions of individual components, and profiles for termite control products.
  - 2. Include the EPA-Registered Label for termiticide products.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.

- B. Product Certificates: For each type of termite control product.

- C. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and include the following:

- 1. Date and time of application.

2. Moisture content of soil before application.
3. Termiticide brand name and manufacturer.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes used, and rates of application.
6. Areas of application.
7. Water source for application.

D. Sample Warranties: For special warranties.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located and who employs workers trained and approved by manufacturer to install manufacturer's products.

## 1.7 FIELD CONDITIONS

A. Soil Treatment:

1. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.
2. Related Work: Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

## 1.8 WARRANTY

- A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work consisting of applied soil termiticide treatment will prevent infestation of subterranean termites[, including Formosan termites (*Coptotermes formosanus*)]. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

1. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain termite control products from single source from single manufacturer.

## 2.2 SOIL TREATMENT

- A. Termiticide: EPA-Registered termiticide acceptable to authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation.
  - 1. Manufacturers: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. BASF Corporation; Termidor.
    - b. Bayer Environmental Science; Premise Pro.
    - c. Ensystem, Inc.; Prother WSP.
    - d. Syngenta; Demon Max.
  - 2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.
- B. Proceed with application only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. General: Prepare work areas according to the requirements of authorities having jurisdiction and according to manufacturer's written instructions before beginning application and installation of termite control treatment(s). Remove extraneous sources of wood cellulose and other edible materials, such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
  - 1. Fit filling hose connected to water source at the site with a backflow preventer, according to requirements of authorities having jurisdiction.

### 3.3 APPLYING SOIL TREATMENT

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Distribute treatment uniformly. Apply treatment at the product's EPA-Registered Label volume

and rate for maximum specified concentration of termiticide to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction.

1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
2. Foundations: Soil adjacent to and along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing.
3. Crawlspace: Soil under and adjacent to foundations. Treat adjacent areas, including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.
4. Masonry: Treat voids.
5. Penetrations: At expansion joints, control joints, and areas where slabs and below-grade walls will be penetrated.

B. Post warning signs in areas of application.

C. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

### 3.4 PROTECTION

A. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

B. Protect termiticide solution dispersed in treated soils and fills from being diluted by exposure to water spillage or weather until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

### 3.5 MAINTENANCE SERVICE

A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of termite-control-treatment Installer. Include annual maintenance as required for proper performance according to the product's EPA-Registered Label and manufacturer's written instructions. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

B. Continuing Maintenance Proposal: Provide from termite-control-treatment Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

1. Include annual inspection for termite activity and effectiveness of termite treatment according to manufacturer's written instructions.



END OF SECTION 313116

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