

Project Manual

## Construction Documents

# Liberty North High School Classroom Remodel

1000 Northeast 104<sup>th</sup> Street  
Liberty, Missouri 64068

Prepared For:

**Liberty Public Schools**

8 Victory Lane

Liberty, Missouri 64068

HM Project No: 21022

Issue Date: March 11, 2024

### **Contents:**

Volume 1: Introductory Information, Bidding and Contracting Requirements,  
Division 1 through Division 28.



we design the future®

**HOLLISANDMILLER.COM**

1828 Walnut Street Suite 922 | Kansas City, MO 64108 | 816.442.7700  
Missouri | Colorado



## **SECTION 000101 - PROJECT TEAM DIRECTORY**

### **PART 1 - GENERAL**

#### **1.1 CONSTRUCTION MANAGER INFORMATION**

- A. Newkirk Novak has been selected as the Construction Manager for this project, and as such, will act as the Owner's representative.
- B. All communication, both written and oral, must be directed through the Construction Manager.

#### **1.2 PROJECT TEAM INFORMATION**

- A. **PROJECT:**
  - 1. Name: Liberty North High School Classroom Remodel
  - 2. Location: 1000 NE 104th Street , Liberty , Missouri 64068
  - 3. Project No: 21022 - WO#189747
- B. **OWNER:**
  - 1. Name: Liberty Public Schools
  - 2. Address: 8 Victory Lane, Liberty, Missouri 64068
  - 3. Contact: Justin Presson
  - 4. Phone: 816.736.5448
- C. **CONSTRUCTION MANAGER:**
  - 1. Name: Newkirk Novak Construction Partners
  - 2. Address: 11200 W. 79th Street, Lenexa, Kansas 66241
  - 3. Contact: Jim Schneider
  - 4. Email: Jim.Schneider@newkirknovak.com
  - 5. Phone: 913.312.9535.
- D. **ARCHITECT:**
  - 1. Name: Hollis + Miller Architects, Inc.
  - 2. Address: 1828 Walnut Street, Suite 922, Kansas City, MO 64108.
  - 3. Contact: Kevin Nelson
  - 4. Email: knelson@hollisandmiller.com
  - 5. Phone: 816.442.7700 / Fax: 816.599.2545
- E. **STRUCTURAL ENGINEER:**
  - 1. Name: Bob D. Campbell & Co.
  - 2. Address: 4338 Belleview Ave, Kansas City, Missouri 64111.
  - 3. Contact: Wayne Davis
  - 4. Email: wdavis@bdc-engrs.com
  - 5. Phone: 816.531.4114 / Fax: 816.531.8572
- F. **MEP ENGINEER:**
  - 1. Name: Smith and Boucher
  - 2. Address: 25618 W 103rd Street, Olathe, Kansas 66061.
  - 3. Contact: Jeremy Enszt
  - 4. Email: jenszt@smithboucher.com
  - 5. Phone: 913.345.2127.

### **PART 2 - PRODUCTS (NOT USED)**

### **PART 3 - EXECUTION (NOT USED)**

**END OF SECTION 000101**

This page intentionally left blank



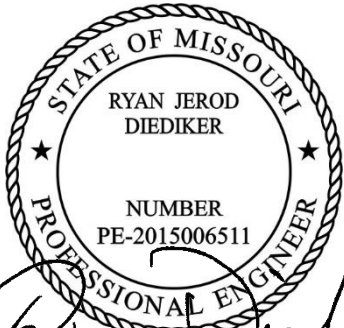
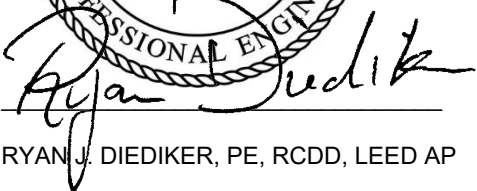
SECTION 000105 - CERTIFICATIONS PAGE-MEP

MEP ENGINEER

I HEREBY, PURSUANT TO RSMO 327.411, STATE THAT THE SPECIFICATIONS INTENDED TO BE AUTHENTICATED BY MY SEAL ARE LIMITED TO SPECIFICATIONS LISTED BELOW:

DIVISION 21 SECTIONS:	211313
DIVISION 22 SECTIONS:	220500, 220516, 220517, 220518, 220523, 220529, 220553, 220719, 221116, 221119, 221316, 221319, 224000
DIVISION 23 SECTIONS:	230500, 230553, 230593, 230713, 233113, 233300, 233713
DIVISION 26 SECTIONS:	260500, 260519, 260523, 260526, 260529, 260533, 260553, 260923, 262726, 265119, 265219
	270000, 270500, 270526
DIVISION 28 SECTIONS	280500, 280513, 283111

I HEREBY DISCLAIM ANY RESPONSIBILITY FOR ALL OTHER SPECIFICATIONS, DRAWINGS, ESTIMATES, REPORTS, OR OTHER DOCUMENTS OR INSTRUMENTS RELATING TO OR INTENDED TO BE USED FOR ANY PART OR PARTS OF THE ARCHITECTURAL OR ENGINEERING PROJECT OR SURVEY.

  
  
\_\_\_\_\_  
RYAN J. DIEDIKER, PE, RCDD, LEED AP

\_\_\_\_\_  
03.11.2024  
DATE



**SECTION 000105 - CERTIFICATIONS PAGE**

ARCHITECT

I HEREBY, PURSUANT TO RSMO 327.411, STATE THAT THE SPECIFICATIONS INTENDED TO BE AUTHENTICATED BY MY SEAL ARE LIMITED TO SPECIFICATIONS LISTED BELOW:

DIVISION 1 SECTIONS:	011000, 012100, 012200, 012500, 012501, 013100, 013200, 013233, 013300, 014000, 014200, 014529, 016000, 017419, 017700, 017823, 017839, 07900.
DIVISION 2 SECTION::	024119
DIVISION 5 SECTION:	055000.
DIVISION 6 SECTION:	061000.
DIVISION 7 SECTION:	079200.
DIVISION 8 SECTIONS:	081113, 081416, 087100, 088000.
DIVISION 9 SECTIONS:	092116, 092900, 093000, 095113, 096519, 096566, 096723, 096816, 099123, 099600.
DIVISION 10 SECTIONS:	101100, 101423, 102600, 102800.
DIVISION 11 SECTIONS:	116623.
DIVISION 12 SECTIONS:	123200.

I HEREBY DISCLAIM ANY RESPONSIBILITY FOR ALL OTHER SPECIFICATIONS, DRAWINGS, ESTIMATES, REPORTS, OR OTHER DOCUMENTS OR INSTRUMENTS RELATING TO OR INTENDED TO BE USED FOR ANY PART OR PARTS OF THE ARCHITECTURAL OR ENGINEERING PROJECT OR SURVEY.

KEVIN NELSON

MARCH 11, 2024

ARCHITECT

DATE



MARCH 11, 2024



## DOCUMENT 000110 – TABLE OF CONTENTS

Project Name: Liberty North High School Classroom Remodel  
Site Address 1000 Northeast 104th Street  
City, State Zip Liberty, Missouri 64068  
Project No.: 21022 WO#189747

Revisions	Date

Latest Revision Original Issue

### INTRODUCTORY INFORMATION

000101	Project Team Directory	03.11.2024
000105	Certifications and Seals	03.11.2024
000110	Table of Contents	03.11.2024

### BIDDING REQUIREMENTS

(Refer to Construction Manager's Front End Manual for additional Bidding Requirements)

### CONTRACTING REQUIREMENTS

(Refer to Construction Manager's Front End Manual for additional Contracting Requirements)

### DIVISION 1 – GENERAL REQUIREMENTS

011000	Summary	03.11.2024
012100	Allowances	03.11.2024
012200	Unit Prices	03.11.2024
012500	Substitution Procedures	03.11.2024
012501	Substitution Procedures Form	03.11.2024
013100	Project Management and Coordination	03.11.2024
013200	Construction Progress Documentation	03.11.2024
013233	Photographic Documentation	03.11.2024
013300	Submittal Procedures	03.11.2024
014000	Quality Requirements	03.11.2024
014200	References	03.11.2024
014529	Testing and Inspections	03.11.2024
016000	Product Requirements	03.11.2024
017419	Construction Waste Management and Disposal	03.11.2024
017700	Closeout Procedures	03.11.2024
017823	Operation and Maintenance Data	03.11.2024
017839	Project Record Documents	03.11.2024
017900	Demonstration and Training	03.11.2024

### DIVISION 2 – EXISTING CONDITIONS

024119	Selective Demolition	03.11.2024
--------	----------------------	------------

### DIVISION 5 - METALS

055000	Metal Fabrications	03.11.2024
--------	--------------------	------------

### DIVISION 6 – WOOD AND PLASTICS

061000	Rough Carpentry	03.11.2024
--------	-----------------	------------

### DIVISION 7 - THERMAL AND MOISTURE PROTECTION

079200	Joint Sealants	03.11.2024
--------	----------------	------------

### DIVISION 8 - DOORS AND WINDOWS

081113	Hollow Metal Doors and Frames	03.11.2024
081416	Flush Wood Doors	03.11.2024
087100	Door Hardware	03.11.2024
088000	Glazing	03.11.2024

**DIVISION 9 - FINISHES**

092116	Non-Structural Metal Framing	03.11.2024
092900	Gypsum Board	03.11.2024
093000	Tiling	03.11.2024
095113	Acoustical Panel Ceilings	03.11.2024
096513	Resilient Base and Accessories	03.11.2024
096519	Resilient Tile Flooring	03.11.2024
096566	Resilient Athletic Flooring	03.11.2024
096723	Resinous Flooring	03.11.2024
096816	Sheet Carpeting	03.11.2024
099123	Interior Painting	03.11.2024
099600	High-Performance Coatings	03.11.2024

**DIVISION 10 – SPECIALTIES**

101100	Visual Display Units	03.11.2024
101423	ADA and Code Signage	03.11.2024
102600	Wall and Door Protection	03.11.2024
102800	Toilet, Bath & Laundry Accessories	03.11.2024

**DIVISION 11 - EQUIPMENT**

116623	Gymnasium Equipment	03.11.2024
--------	---------------------	------------

**DIVISION 12 - FURNISHINGS**

123200	Manufactured Wood Casework	03.11.2024
--------	----------------------------	------------

**DIVISION 21 – FIRE SUPPRESSION**

211313	Wet-Pipe Sprinkler Systems	03.11.2024
--------	----------------------------	------------

**DIVISION 22 - PLUMBING**

220500	Common Work Results for Plumbing	03.11.2024
220516	Expansion Fittings and Loops for Plumbing Piping	03.11.2024
220523	General Duty Valves for Plumbing Piping	03.11.2024
220529	Hangers and Supports for Plumbing Piping and Equipment	03.11.2024
220553	Identification for Plumbing Piping and Equipment	03.11.2024
220719	Plumbing Piping Insulation	03.11.2024
221116	Domestic Water Piping	03.11.2024
221119	Domestic Water Piping Specialties	03.11.2024
221316	Sanitary Waste and Vent Piping	03.11.2024
221319	Sanitary Waste Piping Specialties	03.11.2024
224000	Plumbing Fixtures	03.11.2024

**DIVISION 23 - HEATING, VENTILATING AND AIR CONDITIONING**

230500	Common Work Results for HVAC	03.11.2024
230553	HVAC System Identification	03.11.2024
230593	Testing, Adjusting, and Balancing for HVAC	03.11.2024
230713	Duct Insulation	03.11.2024
233113	Metal Ducts	03.11.2024
233300	Duct Accessories	03.11.2024
233713	Diffusers, Registers, and Grilles	03.11.2024

**DIVISION 26 - ELECTRICAL**

260500	Common Work Results for Electrical	03.11.2024
260519	Low-Voltage Electrical Power Conductors and Cables	03.11.2024
260523	Control-Voltage Electrical Power Cables	03.11.2024
260526	Grounding and Bonding for Electrical Systems	03.11.2024

		Latest Revision	Original Issue
260529	Hangers and Supports for Electrical Systems		03.11.2024
260533	Raceway and Boxes for Electrical Systems		03.11.2024
260553	Identification for Electrical Systems		03.11.2024
260923	Lighting Control Devices		03.11.2024
262726	Wiring Devices		03.11.2024
265119	LED Interior Lighting		03.11.2024
265219	Emergency and Exit Lighting		03.11.2024
DIVISION 27 – COMMUNICATIONS			
270000	District Cabling Specifications		03.11.2024
270500	Common Work Results for Communications		03.11.2024
DIVISION 28 - ELECTRONIC ACCESS CONTROL AND INTRUSION DETECTION			
280500	Common Work Results for Electronic Safety and Security		03.11.2024
280513	Conductors and Cables for Electronic Safety and Security		03.11.2024
283111	Digital, Addressable Fire-Alarm System		03.11.2024
END OF TABLE OF CONTENTS			





## SECTION 011000 - SUMMARY

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Project information.
  - 2. Work covered by Contract Documents.
  - 3. Access to site.
  - 4. Coordination with occupants.
  - 5. Work restrictions.
  - 6. Specification and drawing conventions.
  - 7. Miscellaneous provisions.
- B. Related Requirements:
  - 1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

#### 1.2 PROJECT INFORMATION

- A. Project Identification: Liberty North High School Classroom Remodel
  - 1. Project Address: 1000 NE 104th Street, Liberty, Missouri 64068 .
- B. Owner: **Liberty Public Schools**
  - 1. Refer to Document 000101 "Project Team Directory."
- C. Architect:
  - 1. Refer to Document 000101 "Project Team Directory."
- D. Architect's Consultants: The Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:
  - 1. Refer to Document 000101 "Project Team Directory."
- E. Construction Manager:
  - 1. Refer to Document 000101 "Project Team Directory."
  - 2. Construction Manager has been engaged for this Project to serve as an advisor to Owner and to provide assistance in administering the Contract for Construction between Owner and each Contractor, according to a separate contract between Owner and Construction Manager.

#### 1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
  - 1. General: All demolition, sitework, architectural, structural, fire suppression, plumbing, mechanical, electrical, access control, technology and utilities as indicated in the Contract Documents and as further defined in the Scopes of Work.
- B. Type of Contract:
  - 1. Project will be constructed under a multiple trade contract.

#### 1.4 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.

## 1.5 WORK UNDER SEPARATE CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

## 1.6 ACCESS TO SITE

- A. 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.
- B. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
  - 1. Limits: Confine construction operations to areas indicated and as directed by Construction Manager.
  - 2. Driveways, Walkways, and Entrances: Keep driveways, 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. Restrictions: Note that no deliveries to the Project Site will be allowed between the hours of 7:00 am to 8:30 am and 2:00 pm to 3:30 pm.
    - b. Schedule deliveries to minimize use of driveways and entrances by construction operations.
    - c. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. 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.

## 1.7 COORDINATION WITH OCCUPANTS

- A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.
  - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
  - 2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

## 1.8 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: Limit work in the existing building to normal business working hours of 7:00 a.m. to 4:00 p.m., Monday through Friday, unless otherwise indicated.
  - 1. Weekend Hours: Coordinate and schedule all weekend hours with the Owner not less than 48 hours in advance. Comply with regulations of authorities having jurisdiction.
  - 2. Early Morning Hours: Notify Owner of days when early morning hours will be required and comply with regulations of authorities having jurisdiction.
- 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 Architect and Owner not less than three (3) 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 Architect and Owner not less than three (3) days in advance of proposed disruptive operations.
  - 2. Obtain Owner's written permission before proceeding with disruptive operations.
- E. Nonsmoking Buildings and Sites: Smoking is not permitted on School District property.
- F. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.
- G. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.
- H. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.
  - 1. Maintain list of approved screened personnel with Owner's representative.
  - 2. As a condition for the award of any service contract in excess of \$5,000.00 by the Owner, the service provider must be enrolled in and currently participating in "E-Verify" or any other equivalent electronic verification of work authorization program operated by the U.S. Department of Homeland Security.
  - 3. As a further condition for the award of any service contract in excess of \$5,000.00 the service provider shall not knowingly employ any person who is an un-authorized alien in conjunction with the contracted services.
    - a. E-Verify forms are available for duplication and contractor's use in Section 008400 – Attachments.

## 1.9 SPECIFICATION AND DRAWING CONVENTIONS

- A. 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. Imperative mood and streamlined language are generally used in the Specifications. 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.
  - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- 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 published as part of the U.S. National CAD Standard and scheduled on Drawings.
  - 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 011000

This page intentionally left blank

## **SECTION 012100 - ALLOWANCES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements governing allowances.
  - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
  - 1. Lump-sum allowances.
  - 2. Unit-cost allowances.
- C. Related Requirements:
  - 1. Section 012200 "Unit Prices" for procedures for using unit prices.
  - 2. Section 014000 "Quality Requirements" for procedures governing the use of allowances for testing and inspecting.

#### **1.2 SELECTION AND PURCHASE**

- A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Architect from the designated supplier.

#### **1.3 ACTION SUBMITTALS**

- A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

#### **1.5 COORDINATION**

- A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

## 1.6 LUMP-SUM AND UNIT-COST ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.
  - 1. Sales and Use Taxes shall be omitted for this project.
- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner and/or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.
- C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.
  - 1. If requested by Architect, retain, and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.
- D. Refer to "Bid Packages" for further clarification of required allowances.

## 1.7 ADJUSTMENT OF ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances 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.

## PART 2 PRODUCTS (NOT USED)

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

### 3.2 PREPARATION

- A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

### 3.3 SCHEDULE OF ALLOWANCES

- A. General: Refer to individual Bid Package – Scopes of Work for Allowances.

END OF SECTION 012100

## **SECTION 012200 - UNIT PRICES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for unit prices.
- B. Related Requirements:
  - 1. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
  - 2. Section 014000 "Quality Requirements" for general testing and inspecting requirements.

#### **1.2 DEFINITIONS**

- A. Unit price is an amount incorporated in the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

#### **1.3 PROCEDURES**

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes (other than sales and use tax), overhead, and profit.
- B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
- D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

### **PART 2 PRODUCTS (NOT USED)**

### **PART 3 EXECUTION**

#### **3.1 SCHEDULE OF UNIT PRICES**

- A. Refer to Individual Bid Package – Scopes of Work.

**END OF SECTION 012200**

This page intentionally left blank



## **SECTION 012500 - SUBSTITUTION PROCEDURES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for "Substitutions for Convenience" and "Substitutions for Cause".
- B. Related Requirements:
  - 1. Section 012100 "Allowances" for products selected under an allowance.
  - 2. Section 012200 "Unit Prices" for products selected under a unit price.
  - 3. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.
  - 4. Division 02 through 33 Sections for specific requirements and limitations for substitutions.

#### **1.2 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. Substitutions for Cause shall be submitted after award of the contract as set forth hereinafter.
  - 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. Substitutions for Convenience shall be submitted prior to bidding as set forth hereinafter.
- B. Comparable Products: Naming of specified items on the Drawings and in the specifications, means that such named items are specifically required by the Architect and/or Owner. When the words "or comparable product" follows such named item(s), a substitution request must be submitted when proposing a product other than the named product. Requests for substitutions must be received by the Architect within the time frame set hereinafter.
- C. The following are not considered substitutions:
  - 1. Revisions to Contract Documents requested by the Owner or Architect.
  - 2. Specified options of products, materials and construction methods included in the Contract Documents.

#### **1.3 ACTION SUBMITTALS**

- A. Substitution Requests: Submit at least one (1) paper copy or an electronic pdf copy of each request for consideration to the Architect. Clearly Identify proposed product and related options or fabrication or installation method to be replaced. Include Specification Section number and title, in addition to applicable Drawing numbers and titles.
  - 1. Substitution Request Form: Use facsimile of form provided at the end of this Section.
    - a. Accompanying each Substitution Request shall be a fully executed copy of the Substitution Request Form.
  - 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, if applicable.
    - 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. Specifically indicate deviations, if any, from the Work specified in writing.

- d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
  - e. Samples, where applicable or requested, of proposed substitution and of specified product shall be submitted for comparison and review by Architect.
  - f. Certificates and qualification data, where applicable or requested.
  - g. List of similar installations for completed projects with project names and addresses and names, addresses and contact information of architects and owners.
  - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
  - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
  - j. 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.
  - k. Cost information, including a proposal of change, if any, in the Contract Sum.
  - l. 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.
  - m. 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 Review Process: Submittal requests for proposed substitutions will be processed using the following procedures:
- a. Submittals will be "Received Dated" immediately upon arrival.
  - b. Submittals will be placed by receiving person in a file designated for that purpose.
  - c. Submittals will not be reviewed for completeness or compliance until after the date and time established for closing of receipt of substitution request submittals.
  - d. Submittals will be reviewed by a member of Hollis + Miller Architect's staff (or respective consultant). Reviewer(s) will not be designated until after closing period established for receipt of submittals.
  - e. Reviewer's General Attitude will be:
    - 1) Burden of Proof is on Proposer.
    - 2) Reviewer should not be required to complete the submittal, that is, select from options or between models and lines of products.
    - 3) Reviewer should not be required to conduct an exhaustive review of the submittal. Submittals of manufacturer's catalogs which do not clearly indicate proposed product and proposed product options will be rejected.
    - 4) Reviewer should not be required to seek information from manufacturer's literature on file in the office, from an improperly submitted electronic submittal or information in other locations.
    - 5) Substitute must be "comparable to" or superior in those features and performance which the Project requires and those which the specified product will provide.
    - 6) Review is complete when, in the reviewer's opinion, significant deficiency(ies) are established. In such case, review of data covering other points of specifications is not required.
  - f. Reviewer will note action taken (No Exception taken to Submitted Manufacturer, No Exception taken to Specific Product, Exceptions Noted, Not Accepted or Received Late), the date, and his/her initials.
  - g. All submittals received after closing time will be "Received Dated", marked "Late", initialed by reviewer, and filed without review.
  - h. Submittals will be filed in Architect's office until completion of the Project.
4. Architect's Action:
- a. Architect will review requests for "Substitutions for Convenience" only once, no additional information may be submitted. Architect may request additional information as necessary for review of "Substitutions for Cause."
  - b. Architect will note action taken.
  - c. Architect is not obligated nor required to review any and all substitution requests.
  - d. Architect is not obligated to inform proposers of substitutions of incomplete and non-accepted requests for substitution.
  - e. Acceptance of Substitutions:
    - 1) Acceptance of Substitutions for Convenience: Accepted substitutions will be set forth in an Addendum and in no other manner.
      - (a) Use product specified if Architect does not issue a decision on use of a proposed substitution.
    - 2) Acceptance of Substitutions for Cause: Architect will review proposed substitution within 15 business days of receipt of request. If necessary, Architect, will request additional information or

documentation for evaluation within seven (7) business days of receipt of a request for Substitution for Cause.” Architect will notify Contractor of acceptance of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later. **Only acceptable substitutions will receive notification of status. Substitutions shall be considered unacceptable unless a form of acceptance is received by the Proposer.**

- (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.

#### 1.4 ELECTRONIC SUBMITTAL OF SUBSTITUTIONS

- A. Substitution Request submittals will be accepted for review when submitted electronically under the following conditions. Substitution requests which are not submitted in accordance with the criteria listed below may be rejected at the Architect's discretion.
  - 1. Accompanying each submittal shall be a fully executed copy of the Substitution Request Form.
  - 2. Submittals shall be sent to Hollis + Miller Architects, to the attention of the contact listed in Document 000101 "Project Team Directory. Submittals directed to the attention of anyone other than the contact listed will not be considered.
  - 3. Submittals of Substitutions for Cause must be received within the time limits set forth in Paragraph 2.1 A of this Section.
  - 4. Submittals of Substitutions for Convenience must be received prior to bidding and within the time limits set forth in Paragraph 2.1 B of this Section.
  - 5. Documentation requirements as set forth in 1.3 A.2a through 1.3 A.2m are applicable to electronic submittals.
    - a. Note: Electronic submittals in which the manufacturer's entire catalog is submitted will be rejected.

#### 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. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions at no additional cost to the Owner.

### 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 thirty (30) days prior to time required for preparation and review of related submittals.
  - 1. Conditions: Architect and Owner 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. Request is directly related to a "or comparable product" clause or similar language in the Contract Documents.
    - c. Specified product or method of construction cannot be provided within the Contract Time.
    - d. Specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.
    - e. Specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution will provide the specified warranty.

- f. Substitution request is fully documented and properly submitted.
  - g. Requested substitution will not adversely affect Contractor's construction schedule.
  - h. Requested substitution has received necessary approvals of authorities having jurisdiction.
  - i. Requested substitution is compatible with other portions of the Work.
  - j. Requested substitution has been coordinated with other portions of the Work.
  - k. Requested substitution provides specified warranty.
  - l. 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: Architect will consider requests for substitution only when submitted prior to bidding, and no later than 4:00 p.m. (local time) eight (8) calendar days prior to the date established for receipt of bids. Requests received after that time may be considered or rejected at discretion of Architect.
  - 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 offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
    - b. Requested substitution does not require extensive revisions to the Contract Documents.
    - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    - d. Substitution request is fully documented and properly submitted.
    - e. Requested substitution will not adversely affect Contractor's construction schedule.
    - f. Requested substitution has received necessary approvals of authorities having jurisdiction.
    - g. Requested substitution is compatible with other portions of the Work.
    - h. Requested substitution has been coordinated with other portions of the Work.
    - i. Requested substitution provides specified warranty.
    - j. 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.
- C. The Contractor's submittal and A/E's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptance or validate request for substitution, nor does it constitute approval.
- D. Under no circumstances does the Architect's and/or Owner's acceptance of any such substitution relieve the Contractor from timely, full and proper performance of the Work.

PART 3 - EXECUTION (NOT USED)

END OF SECTION 012500

**SECTION 012501 - SUBSTITUTION PROCEDURES FORM**

**PROJECT:** Liberty North High School Classroom Renovation WO# 189747 1000 Northeast 104th St, Liberty, MO 64068  
**MAIL TO:** HOLLIS + MILLER ARCHITECTS, 1828 WALNUT STREET, SUITE 922, KANSAS CITY, MISSOURI 64108

**SPECIFIED ITEM/ KEYNOTE #:** \_\_\_\_\_

**PROPOSED SUBSTITUTE:** \_\_\_\_\_

**SUBMITTED BY:** \_\_\_\_\_

**FIRM:** \_\_\_\_\_

**ADDRESS:** \_\_\_\_\_

**SIGNATURE:** \_\_\_\_\_ **DATE:** \_\_\_\_\_

**PHONE NUMBER:** \_\_\_\_\_

ATTACH COMPLETE DESCRIPTION, DESIGNATION, CATALOG OR MODEL NUMBER, SPEC DATA SHEET AND OTHER TECHNICAL DATA AND SAMPLES, INCLUDING LABORATORY TESTS IF APPLICABLE.

*FILL IN BLANKS BELOW:*

1. WILL SUBSTITUTION AFFECT DIMENSION INDICATED ON DRAWINGS?
2. WILL SUBSTITUTION AFFECT WIRING, PIPING, DUCTWORK, ETC., INDICATED ON DRAWINGS?
3. WHAT EFFECT WILL SUBSTITUTION HAVE ON OTHER TRADES?
4. DIFFERENCES BETWEEN PROPOSED SUBSTITUTION AND SPECIFIED ITEM?
5. ANY AND ALL IMPACTS ON COSTS, DESIGN MODIFICATIONS, ADDITIONAL ARCHITECTURAL AND ENGINEERING SERVICES, MATERIAL AND LABOR CHANGES, SCHEDULE CHANGES, AND OTHER UNANTICIPATED CONSEQUENCES, RESULTING FROM THIS SUBSTITUTION IN LIEU OF THE SPECIFIED ITEM, SHALL BE THE FULL

RESPONSIBILITY OF THE CONTRACTOR AND HIS SUBCONTRACTORS AND SUPPLIER.

6. MANUFACTURER'S WARRANTIES OF THE SPECIFIED ITEMS AND PROPOSED ITEMS ARE: ☐ SAME OR  
☐ DIFFERENT, *EXPLAIN:* \_\_\_\_\_

**REVIEW COMMENTS:**

☐ **NO EXCEPTION TAKEN TO SUBMITTED MANUFACTURER**  
*MANUFACTURER ONLY, IS ACCEPTED DUE TO TIME LIMITATIONS FOR FULL REVIEW OF PRODUCT, OR  
BECAUSE NO SPECIFIC PRODUCT DATA IS SUBMITTED, OR OTHER UNSPECIFIED REASONS. CONTRACTOR  
MUST STILL BEAR FULL RESPONSIBILITY FOR COMPLIANCE WITH CONTRACT REQUIREMENTS.*

☐ **NO EXCEPTION TAKEN TO SPECIFIC PRODUCTS**

☐ **EXCEPTIONS NOTED**  
*SEE ATTACHED COPY OR NOTES ON PRODUCT LITERATURE*

☐ **NOT ACCEPTED**

☐ **RECEIVED TOO LATE**

BY: \_\_\_\_\_ DATE: \_\_\_\_\_  
REMARKS: \_\_\_\_\_

END OF SECTION

## **SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION**

### **PART 1 - GENERAL**

#### **1.1 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. On-line Project file.
  - 5. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- C. Related Requirements:
  - 1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
  - 2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
  - 3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

#### **1.2 DEFINITIONS**

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

#### **1.3 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. Use form acceptable to Construction Manager. 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 ten (10) 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 addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project. Keep list current at all times.
  - 1. Post paper copies of list in project meeting room, in temporary field office, and by each temporary telephone.
  - 2. Post electronic copy as PDF electronic files directly to Project file on the JE Dunn Submittal Portal website (<https://submittals.jedunn.com>) specifically established for Project.

#### **1.4 GENERAL COORDINATION PROCEDURES**

- A. 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.
- B. 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.
- C. 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.
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
1. Refer to Section 017419 "Construction Waste Management and Disposal" for additional requirements.

## 1.5 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 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 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 subframing 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.
  7. Electrical Work: Show the following:
    - a. Runs of vertical and horizontal conduit 1-1/4 inches 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.
  8. Fire-Protection System: Show the following:
    - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
  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: As deemed necessary by Construction Manager, prepare coordination drawing prints according to requirements in Section 013300 "Submittal Procedures."
- C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:
1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
  2. File Submittal Format: Submit or post coordination drawing files using Portable Data File (PDF) format.
  3. BIM File Incorporation: Develop and incorporate coordination drawing files into Building Information Model established for Project.
    - a. Refer to individual Scopes of Work for Trades required to perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.
  4. Architect, through Construction Manager, will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
    - a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
    - b. Digital Drawing Software Program: The Contract Drawings are available in Revit version 2023 using Windows 10 operating system.
    - c. Contractor shall execute a data licensing agreement in the form of Agreement included in Project Manual.

## 1.6 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. Architect will return RFIs submitted to Architect by other entities controlled by Contractor 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.
- 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. Name of Construction Manager.
  7. RFI number, numbered sequentially.
  8. RFI subject.
  9. Specification Section number and title and related paragraphs, as appropriate.

10. Drawing number and detail references, as appropriate.
  11. Field dimensions and conditions, as appropriate.
  12. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  13. Contractor's signature.
  14. 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 or a software-generated form with substantially the same content as indicated above, acceptable to Architect.
1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- D. Architect's and Construction Manager's Action: Architect and Construction Manager will review each RFI, determine action required, and respond. Allow seven (7) working days for Architect's response for each RFI. RFIs received by Architect or Construction Manager 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. 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.
  3. 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 and Construction Manager 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 weekly in form acceptable to Architect. Include the following:
1. Project name.
  2. Name and address of Contractor.
  3. Name and address of Architect.
  4. Name and address of Construction Manager.
  5. RFI number including RFIs that were returned without action or withdrawn.
  6. RFI description.
  7. Date the RFI was submitted to the Architect.
  8. Date Architect's and Construction Manager's response was received.
- F. On receipt of Architect's and Construction Manager's action, immediately distribute the RFI response to affected parties. Review response and notify Architect and Construction Manager within seven (7) days if Contractor disagrees with response.
1. Change in Work shall be recorded to the Project Record set per Section 017839 "Project Record Documents".

## 1.7 PROJECT MEETINGS

- A. General: Construction Manager will 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: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, Construction Manager, and Architect, within three (3) days of the meeting.

- B. Preconstruction Conference: Construction Manager will 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, Construction Manager, Architect, and their consultants; each 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. Preparation of record documents.
    - m. Use of the premises.
    - n. Work restrictions.
    - o. Working hours.
    - p. Owner's occupancy requirements.
    - q. Responsibility for temporary facilities and controls.
    - r. Procedures for moisture and mold control.
    - s. Procedures for disruptions and shutdowns.
    - t. Construction waste management and recycling.
    - u. Parking availability.
    - v. Office, work, and storage areas.
    - w. Equipment deliveries and priorities.
    - x. First aid.
    - y. Security.
    - z. Progress cleaning.
  4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation 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, Construction Manager, and Owner's Commissioning Authority 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. Review of mockups.
    - i. Possible conflicts.
    - j. Compatibility requirements.
    - k. Time schedules.
    - l. Weather limitations.
    - m. Manufacturer's written instructions.
    - n. Warranty requirements.

- o. Compatibility of materials.
  - p. Acceptability of substrates.
  - q. Temporary facilities and controls.
  - r. Space and access limitations.
  - s. Regulations of authorities having jurisdiction.
  - t. Testing and inspecting requirements.
  - u. Installation procedures.
  - v. Coordination with other work.
  - w. Required performance results.
  - x. Protection of adjacent work.
  - y. 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.
- D. Project Closeout Conference: Construction Manager will schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 60 days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
  2. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Construction Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
  3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
    - a. Preparation of record documents.
    - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
    - c. Submittal of written warranties.
    - d. Requirements for preparing operations and maintenance data.
    - e. Requirements for delivery of material samples, attic stock, and spare parts.
    - f. Requirements for demonstration and training.
    - g. Preparation of Contractor's punch list.
    - h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
    - i. Submittal procedures.
    - j. Owner's partial occupancy requirements.
    - k. Installation of Owner's furniture, fixtures, and equipment.
    - l. Responsibility for removing temporary facilities and controls.
  4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Construction Manager will conduct progress meetings at **biweekly** intervals.
1. Coordinate dates of meetings with preparation of payment requests.
  2. Attendees: In addition to representatives of Owner, Owner's Commissioning Authority, Construction Manager, 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) Resolution of BIM component conflicts.

- 4) Status of submittals.
  - 5) Status of sustainable design documentation.
  - 6) Deliveries.
  - 7) Off-site fabrication.
  - 8) Access.
  - 9) Site utilization.
  - 10) Temporary facilities and controls.
  - 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: Entity 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: Construction Manager will 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 preinstallation conferences.
1. Attendees: In addition to representatives of Owner, 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. Owner's Commissioning Authority, Construction Manager, and Architect will attend as deemed necessary.
  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) Resolution of BIM component conflicts.
      - 4) Status of submittals.
      - 5) Deliveries.
      - 6) Off-site fabrication.
      - 7) Access.
      - 8) Site utilization.
      - 9) Temporary facilities and controls.
      - 10) Work hours.
      - 11) Hazards and risks.
      - 12) Progress cleaning.
      - 13) Quality and work standards.
      - 14) 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

## **SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
  - 1. Startup construction schedule.
  - 2. Contractor's construction schedule.
  - 3. Construction schedule updating reports.
  - 4. Daily construction reports.
  - 5. Material location reports.
  - 6. Site condition reports.
  - 7. Special reports.
- B. Related Requirements:
  - 1. Section 013300 "Submittal Procedures" for submitting schedules and reports.
  - 2. Section 014529 "Testing and Inspections" for submitting a schedule of tests and inspections.

#### **1.2 DEFINITIONS**

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
  - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
  - 2. Predecessor Activity: An activity that precedes another activity in the network.
  - 3. Successor Activity: An activity that follows another activity in the network.
- B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- D. Event: The starting or ending point of an activity.
- E. Float: The measure of leeway in starting and completing an activity.
  - 1. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
  - 2. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- F. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Format for Submittals: Submit required submittals in the following format:
  - 1. Working electronic copy of schedule file, where indicated.
  - 2. PDF electronic file
- B. Startup construction schedule.
  - 1. Approval of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.

- C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
  - 1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.
- D. Construction Schedule Updating Reports: Submit with Applications for Payment.
- E. Daily Construction Reports: Submit at monthly intervals.
- F. Material Location Reports: Submit at monthly intervals.
- G. Site Condition Reports: Submit at time of discovery of differing conditions.
- H. Special Reports: Submit at time of unusual event.
  - 1. Adverse Weather Days: Document conditions effecting construction activities and submit within 24 hours of the event.

#### 1.4 QUALITY ASSURANCE

- A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:
  - 1. Review software limitations and content and format for reports.
  - 2. Verify availability of qualified personnel needed to develop and update schedule.
  - 3. Discuss constraints, including phasing, work stages, area separations and interim milestones.
  - 4. Review delivery dates for Owner-furnished products.
  - 5. Review submittal requirements and procedures.
  - 6. Review time required for review of submittals and resubmittals.
  - 7. Review requirements for tests and inspections by independent testing and inspecting agencies.
  - 8. Review time required for Project closeout and Owner startup procedures, including commissioning activities.
  - 9. Review and finalize list of construction activities to be included in schedule.
  - 10. Review procedures for updating schedule.

#### 1.5 COORDINATION

- A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
  - 1. Secure time commitments for performing critical elements of the Work from entities involved.
  - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

### PART 2 PRODUCTS

#### 2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.
  - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
  - 1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
  - 2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.



3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
  4. Startup and Testing Time: Include no fewer than 20 days for startup and testing.
  5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's and Construction Manager's administrative procedures necessary for certification of Substantial Completion.
  6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
  2. Work under More Than One Contract: Include a separate activity for each contract.
  3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner, if any.
  4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
  5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
  6. Work Restrictions: Show the effect of the following items on the schedule:
    - a. Coordination with existing construction.
    - b. Uninterruptible services.
    - c. Use of premises restrictions.
    - d. Provisions for future construction.
    - e. Seasonal variations.
    - f. Environmental control.
  7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
    - a. Subcontract awards.
    - b. Submittals.
    - c. Purchases.
    - d. Mockups.
    - e. Fabrication.
    - f. Sample testing.
    - g. Deliveries.
    - h. Installation.
    - i. Tests and inspections.
    - j. Adjusting.
    - k. Curing.
    - l. Building flush-out.
    - m. Startup and placement into final use and operation.
  8. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
    - a. Structural completion.
    - b. Temporary enclosure and space conditioning.
    - c. Permanent space enclosure.
    - d. Completion of mechanical installation.
    - e. Completion of electrical installation.
    - f. Substantial Completion.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.
- E. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
1. See Section 012900 "Payment Procedures" for cost reporting and payment procedures.
- F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.

2. Unanswered Requests for Information.
  3. Rejected or unreturned submittals.
  4. Notations on returned submittals.
  5. Pending modifications affecting the Work and Contract Time.
- G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.
- H. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

## 2.2 STARTUP CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within seven (7) days of date established for the Notice to Proceed or Notice of Award, whichever is earlier.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

## 2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. CPM Schedule: Prepare Contractor's construction schedule using a time-scaled CPM network analysis diagram for the Work.
1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 30 days after date established for the Notice to Proceed.
    - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
  2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
  3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
  4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
1. Refer to Section 007300 for additional requirements.
- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.
- F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities.
- G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
  2. Changes in early and late start dates.
  3. Changes in early and late finish dates.
  4. Changes in activity durations in workdays.

5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

## 2.4 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 30 days of date established for the Notice to Proceed or the Notice of Award, whichever is earlier. Base schedule on the startup construction schedule and additional information received since the start of Project.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
  1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

## 2.5 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
  1. List of subcontractors at Project site.
  2. List of separate contractors at Project site.
  3. Approximate count of personnel at Project site.
  4. Equipment at Project site.
  5. Material deliveries.
  6. High and low temperatures and general weather conditions, including presence of rain or snow.
  7. Accidents.
  8. Meetings and significant decisions.
  9. Unusual events (see special reports).
  10. Stoppages, delays, shortages, and losses.
  11. Meter readings and similar recordings.
  12. Emergency procedures.
  13. Orders and requests of authorities having jurisdiction.
  14. Change Orders received and implemented.
  15. Construction Change Directives received and implemented.
  16. Services connected and disconnected.
  17. Equipment or system tests and startups.
  18. Partial completions and occupancies.
  19. Substantial Completions authorized.
- B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:
  1. Material stored prior to previous report and remaining in storage.
  2. Material stored prior to previous report and since removed from storage and installed.
  3. Material stored following previous report and remaining in storage.
- C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

## 2.6 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner, Architect and Construction Manager within two day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating,

response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

## PART 3 EXECUTION

### 3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
  - 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
  - 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
  - 3. As the Work progresses, indicate final completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Architect, Construction Manager, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
  - 1. Post copies in Project meeting rooms and temporary field offices.
  - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

## **SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION**

### **PART 1 GENERAL**

#### **1.1 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 017700 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.
  - 2. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

#### **1.2 INFORMATIONAL SUBMITTALS**

- A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- B. Digital Photographs: Submit image files within three days of taking photographs.
  - 1. Submit photos by uploading to web-based project software site or via email. Include copy of key plan indicating each photograph's location and direction.
  - 2. Identification: Provide the following information with each image description:
    - 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 location, vantage point, and direction.
    - g. Unique sequential identifier keyed to accompanying key plan.

#### **1.3 FORMATS AND MEDIA**

- A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels. Use flash in low light levels or backlit conditions.
- B. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
- C. Metadata: Record accurate date and time from camera.
- D. File Names: Name media files with date, Project area, and sequential numbering suffix.

#### **1.4 CONSTRUCTION PHOTOGRAPHS**

- A. General: Take photographs with maximum depth of field and in focus.
  - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- B. 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.

1. Flag construction limits before taking construction photographs.
  2. Take a minimum of 20 photographs to show existing conditions adjacent to property before starting the Work.
  3. Take a minimum of 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.
- C. Periodic Construction Photographs: Take a minimum of 20 photographs biweekly. Select vantage points to show status of construction and progress since last photographs were taken.
- D. Final Completion Construction Photographs: Take a minimum of 20 photographs after date of Substantial Completion for submission as Project Record Documents. Architect will inform photographer of desired vantage points.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 013233

## **SECTION 013300 - SUBMITTAL PROCEDURES**

### **PART 1 - GENERAL**

#### **1.1 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 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
  - 3. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
  - 4. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and Record Product Data.

#### **1.2 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. Digital File Transfer: Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. A cloud based ShareFile exchange which allows internal and external users to access files.
- D. 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.

#### **1.3 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: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. 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.
    - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
  - 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 installation.
    - i. Scheduled dates for purchasing.

## 1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect to Contractor, at a nominal cost, for use in preparing submittals.
1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.
    - a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
    - b. Digital Drawing Software Program: The Contract Drawings are available in Revit version 2023 using minimum Windows 10 operating system.
    - c. Contractor shall execute a data licensing agreement form furnished by the Architect.
- 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. It is expected that the number of submittals sent to the Architect and the Architect's Consultants within any one-week period will be reasonable in number as to not create "undue hardship."
  2. It is expected that all submittals will be submitted within the durations outlined in the bid form as provided by each trade.
    - a. A \$100.00 per calendar day penalty will be assessed for any submittal received after durations received as provided by each trade. The penalty will be deducted from the contract through deductive change order. Only if written authorization from the Architect to extend this time frame can this "per day" penalty not be enforced.
    - b. The completion time of the contract will not be extended for delays caused by tardiness of submittals. Cost of such delays shall not be borne by the Owner and may be back-charged as necessary.
      - 1) Contractor shall assume full responsibility for providing materials as specified at their risk to maintain schedule if submittals are not submitted within durations provided on the bid form.
    - c. Upon receipt of unapproved submittals, Contractors will have seven (7) calendar days to revise and resubmit. After such time, the penalty outlined above in 1.4 C.1.a will be assessed.
  3. Initial Review: Allow 10 **business** 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.
  4. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
  5. Resubmittal Review: Allow 7 **business** days for review of each resubmittal.
  6. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 **business** days for initial review of each submittal.
  7. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 **business** days for review of each submittal. Submittal will be returned to Architect, before being returned to Contractor.
- D. 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 and transmittal form with links enabling navigation to each item.
  2. Name file with submittal number or other unique identifier, including revision identifier.
    - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., OMLC-079200.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., OMLC-079200.01.A).
    - b. Specific material/product identifier: After listing the project identifier and section number as described above, clearly indicate the material/product submitted corresponding to specific paragraph in the



- specification (e.g., Silicone Joint Sealant – 2.2 A).
3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
  4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software or electronic form acceptable to Owner, containing the following information:
    - a. Project name.
    - b. Date.
    - c. Name and address of Architect.
    - d. Name of Contractor.
    - e. Name of firm or entity that prepared submittal.
    - f. Names of subcontractor, manufacturer, and supplier.
    - g. Category and type of submittal.
    - h. Submittal purpose and description.
    - i. Specification Section number and title.
    - j. Specification paragraph number or drawing designation and generic name for each of multiple items.
    - k. Drawing number and detail references, as appropriate.
    - l. Location(s) where product is to be installed, as appropriate.
    - m. Related physical samples submitted directly.
    - n. Indication of full or partial submittal.
    - o. Transmittal number, numbered consecutively.
    - p. Submittal and transmittal distribution record.
    - q. Other necessary identification.
    - r. Remarks.
  5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
    - a. Project name.
    - b. Number and title of appropriate Specification Section.
    - c. Manufacturer name.
    - d. Product name.
- E. Options: Clearly identify options requiring selection by Architect.
- F. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
  1. Note date and content of previous submittal.
  2. Note date and content of revision in label or title block and clearly indicate extent of revision.
  3. 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.
    - b. Along with the electronic submittal, Contractor shall submit to the Architect, one (1) full sized hard copy of each shop drawing for review and approval, as deemed necessary by the Architect.

- c. Along with the electronic submittal, contractors shall submit to the Architect, one (1) color deck or color card for each submittal requiring color selection for review, approval and color selection, as deemed necessary by the Architect.
  2. 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.
    - a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
    - b. Provide a notarized statement on original paper copy certificates and certifications where indicated.
  3. Submittals shall constitute an implied statement by the General Contractor and Subcontractor that the submitted items comply with the following statements:
    - a. Items have been reviewed and accepted by the General Contractor and Subcontractor.
    - b. Items have been verified and coordinated with specifications, measurements, conditions, and relevant criteria of the Contract Documents.
    - c. Items can be fabricated and delivered to the project site within the proposed project schedule.
  4. Review of submittals by the Architect and/or Owner shall not relive the Contractor from full compliance with the Construction Documents.
- 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 clearly 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. Standard color charts/decks.
    - d. Statement of compliance with specified referenced standards.
    - e. Testing by recognized testing agency.
    - f. Application of testing agency labels and seals.
    - g. Notation of coordination requirements.
    - h. Availability and delivery time information.
  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 and Shop Drawings, as applicable.
  6. Submit Product Data in the following format:
    - a. PDF electronic file according to Paragraph 2.1 A.1.
- 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, unless submittal based on Architect's digital data drawing files is otherwise permitted.
  1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    - a. Identification of products.
    - b. Schedules.
    - c. Compliance with specified standards.
    - d. Notation of coordination requirements.
    - e. Notation of dimensions established by field measurement.
    - f. Relationship and attachment to adjoining construction clearly indicated.
    - g. Seal and signature of professional engineer if specified.
  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, but no larger than 30 by 42 inches.
  3. Submit Shop Drawings in the following format:
    - a. PDF electronic file according to Paragraph 2.1 A.1.
- 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.
    - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
  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. Sample for "initial selection" shall be listed as a separate item in the submittal schedule.
    - b. Number of Samples: Unless specifically required otherwise in Specification Section, 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. Mark up and retain one returned Sample set as a project record sample.
      - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
  7. Electronic Transmittal: Provide PDF transmittal for all physical Samples. Include digital image file illustrating Sample characteristics, and identification information for record.
- E. Product Schedule: As required in individual Specification Sections, 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. Number and name of room or space.
  4. Location within room or space.
  5. Submit product schedule in the following format:
    - a. PDF electronic file.
- 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 in the Contract Documents. 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 in the Contract Documents 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 in the Contract Documents. Include evidence of manufacturing experience where required.
- P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- 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 in the Contract Documents.
- S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. 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. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- V. 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.
- W. Field Test Reports: Submit written reports 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 in the Contract Documents.
- X. 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.

## 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 in addition to 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.
- C. BIM File Incorporation: Incorporate delegated-design drawing and data files into Building Information Model established for Project.
1. Prepare delegated-design drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.

## 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 Project name and location, submittal number, Specification Section title and number, 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. General: Architect will not review submittals that do not bear the Contractor's approval stamp and will return them without action.
- B. Action Submittals: Contractor is responsible for conforming and correlating dimensions at job sites for tolerances, clearances, quantities, fabrication processes, coordination of the Work with multiple trades, and full compliance with the Contract Documents. The Architect will review submittals for general conformance with the Contract Documents. 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: Signifies item represented in the submittal conforms to the design intent, complies with the intent of the Contract Documents and is acceptable for incorporation into the Work. Contractor is to proceed with fabrication or procurement and related work.
  2. Exceptions Noted: Signifies item represented in the submittal conforms to the design concept, complies with the intent of the Contract Documents and is recommended for incorporation into the Work in accordance with the Architect's and/or Consultant's notations. Contractor is to proceed with the work in accordance the Architect's and/or Consultant's notations marked on the returned submittal or letter of transmittal. Resubmittal is not required.
  3. Revised and Resubmit: Signifies item represented in the submittal appears to conform to the design concept and comply with the intent of the Contract Documents, but information is either insufficient or contains discrepancies which prevent the Architect and/or his Consultant from completing his review. Contractor is to resubmit revised information. Fabrication or procurement of the item and related work is not to proceed until the submittal is acceptable.
  4. Not Accepted: Signifies item represented in the submittal does not conform to the design concept or comply with the intent of the Contract Documents and is not recommended for incorporation into the Work. Contractor shall submit items responsive to the Contract Documents.

- C. 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.
- D. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- E. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- F. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 013300

## SECTION 014000 - QUALITY REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 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, Commissioning Authority or authorities having jurisdiction are not limited by provisions of this Section.
  - 4. Specific test and inspection requirements are not specified in this Section.

#### 1.2 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/Field Samples: Full-size physical assemblies that are constructed on-site. Mockups/field samples 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/Field Samples are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. 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).

- J. Experienced: When used with an entity or individual, "experienced" means, unless otherwise specified in the individual specification section, having successfully completed a minimum of five (5) 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.

### 1.3 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.

### 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. Whenever Contract Documents reasonably infer materials or installation as necessary to produce the intended results, but do not fully detail or specify such materials, the Contractor shall provide the more expensive method or material, or greater quantity, unless he has obtained a written decision from the Architect.

### 1.5 ACTION SUBMITTALS

- A. Shop Drawings: For integrated exterior mockups/field samples, provide plans, sections, and elevations, indicating materials and size of mockup construction.
  - 1. Indicate manufacturer and model number of individual components.
  - 2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.
- B. Delegated-Design Services 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 INFORMATIONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- 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. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
1. Specification Section number and title.
  2. Entity responsible for performing tests and inspections.
  3. Description of test and inspection.
  4. Identification of applicable standards.
  5. Identification of test and inspection methods.
  6. Number of tests and inspections required.
  7. Time schedule or time span for tests and inspections.
  8. Requirements for obtaining samples.
  9. Unique characteristics of each quality-control service.

## 1.7 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
1. Project quality-control manager may also serve as Project superintendent.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
  2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
  3. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by the Commissioning Authority.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

## 1.8 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. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of factory-authorized service representative making report.
  2. Statement that equipment complies with requirements.
  3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  4. Statement whether conditions, products, and installation will affect warranty.
  5. Other required items indicated in individual Specification Sections.
- D. 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.

## 1.9 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.
1. Refer to individual specification sections for additional requirements.
- 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 requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or 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.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
  2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- 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. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
1. Contractor responsibilities include the following:
    - a. Provide test specimens representative of proposed products and construction.
    - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
    - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
    - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
    - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
    - f. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.
  2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- K. 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 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.
    - a. Allow seven days for initial review and each re-review of each mockup.
  6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  7. Unless otherwise indicated in the Contract Documents, demolish and remove mockups when directed unless otherwise indicated.
- L. Integrated Exterior Mockups: Construct integrated exterior mockup as indicated on Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials.
- M. Field Samples: Construct/apply field samples using required materials, products, finishes and assemblies, finished according to requirements for the completed work. Provide required lighting and additional lighting where required to enable Architect to evaluate quality of the Work:
1. Build field sample of size indicated or, if not indicated, as directed by Architect.
  2. Notify Architect three (3) days in advance of dates and times when field samples will be constructed/applied.
  3. Notify Architect seven (7) days in advance of dates and times when field sample will be constructed/applied.
  4. Demonstrate the proposed aesthetic effects and workmanship to be incorporated into the Work.
  5. Obtain Architect's approval of field sample before starting remainder of work.
    - a. Allow three (3) days for initial review and each re-review of each field sample.
  6. Field samples not acceptable to Architect shall be re-constructed/re-applied until field sample is accepted to Architect.
  7. Maintain field sample during construction in an undisturbed condition as a standard for judging the completed Work

8. Unless otherwise indicated in the Contract Documents, dispose of field sample when directed by Architect and Owner.

## 1.10 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. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
  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 Contract Documents.
- F. Testing Agency Responsibilities: Cooperate with Architect, Commissioning Authority, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
  1. Notify Architect, Commissioning Authority, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
  3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
  4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
  5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
  6. 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.
- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents as a component of Contractor's quality-control plan. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.
1. Distribution: Distribute schedule to Owner, Architect, Commissioning Authority, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

#### 1.11 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner will engage a qualified testing agency or special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:
1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
  2. Notifying Architect, Commissioning Authority, and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
  3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect and Commissioning Authority, with copy to Contractor and to authorities having jurisdiction.
  4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
  5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
  6. Retesting and reinspecting corrected work.

#### 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, and 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 017300 "Execution."

- 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 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.

#### 1.2 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. 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.

#### 1.3 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.concrete.org](http://www.concrete.org).

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. AWPA - 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.bwfbadminton.org](http://www.bwfbadminton.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.compositepanel.org](http://www.compositepanel.org).
60. CRI - Carpet and Rug Institute (The); [www.carpet-rug.org](http://www.carpet-rug.org).
61. CRRC - Cool Roof Rating Council; [www.coolroofs.org](http://www.coolroofs.org).
62. CRSI - Concrete Reinforcing Steel Institute; [www.crsi.org](http://www.crsi.org).
63. CSA - Canadian Standards Association; [www.csa.ca](http://www.csa.ca).
64. CSA - CSA International; (Formerly: IAS - International Approval Services); [www.csa-international.org](http://www.csa-international.org).
65. CSI - Construction Specifications Institute (The); [www.csiresources.org](http://www.csiresources.org).
66. CSSB - Cedar Shake & Shingle Bureau; [www.cedarbureau.org](http://www.cedarbureau.org).
67. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); [www.cti.org](http://www.cti.org).
68. CWC - Composite Wood Council; (See CPA).



69. DASMA - Door and Access Systems Manufacturers Association; [www.dasma.com](http://www.dasma.com).
70. DHI - Door and Hardware Institute; [www.dhi.org](http://www.dhi.org).
71. ECA - Electronic Components Association; (See ECIA).
72. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
73. ECIA - Electronic Components Industry Association; [www.eciaonline.org](http://www.eciaonline.org).
74. EIA - Electronic Industries Alliance; (See TIA).
75. EIMA - EIFS Industry Members Association; [www.eima.com](http://www.eima.com).
76. EJMA - Expansion Joint Manufacturers Association, Inc.; [www.ejma.org](http://www.ejma.org).
77. ESD - ESD Association; (Electrostatic Discharge Association); [www.esda.org](http://www.esda.org).
78. ESTA - Entertainment Services and Technology Association; (See PLASA).
79. EVO - Efficiency Valuation Organization; [www.evo-world.org](http://www.evo-world.org).
80. FCI - Fluid Controls Institute; [www.fluidcontrolsinstitute.org](http://www.fluidcontrolsinstitute.org).
81. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); [www.fiba.com](http://www.fiba.com).
82. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); [www.fivb.org](http://www.fivb.org).
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](http://www.ili.ai).
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 Federation of State High School Associations; [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. DIN - Deutsches Institut für Normung e.V.; [www.din.de](http://www.din.de).
  2. IAPMO - International Association of Plumbing and Mechanical Officials; [www.iapmo.org](http://www.iapmo.org).
  3. ICC - International Code Council; [www.iccsafe.org](http://www.iccsafe.org).
  4. 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/fdsys](http://www.gpo.gov/fdsys).
  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. CFR - Code of Federal Regulations; Available from Government Printing Office; [www.gpo.gov/fdsys](http://www.gpo.gov/fdsys).
  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. 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).
  - 6. MILSPEC - Military Specification and Standards; (See DOD).
  - 7. USAB - United States Access Board; [www.access-board.gov](http://www.access-board.gov).
  - 8. 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.txforestservation.tamu.edu](http://www.txforestservation.tamu.edu).
  - 8. Colorado Department of Public Health & Environment; [www.colorado.gov/pacific/cdphe](http://www.colorado.gov/pacific/cdphe)
  - 9. Colorado Air Quality Control Commission; [www.colorado.gov/pacific/cdphe/aqcc](http://www.colorado.gov/pacific/cdphe/aqcc)
  - 10. Colorado Water Quality Control Division; [www.colorado.gov/pacific/cdphe/wqcd](http://www.colorado.gov/pacific/cdphe/wqcd)
  - 11. Colorado Geological Survey; Land Use Regulations; [www.coloradogeologicalsurvey.org/land-use-regulations/](http://www.coloradogeologicalsurvey.org/land-use-regulations/)

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION 014200

## **SECTION 014529 - TESTING AND INSPECTIONS**

### **PART 1 - GENERAL**

#### **1.1 GENERAL**

- A. The preceding "General Conditions" are a part of these specifications and the Contractor shall consult them in detail in connection with this part of the work.

#### **1.2 SCOPE OF WORK**

- A. Employment of a testing and inspection firm approved and paid for by the Owner. Approximate scope of testing and inspection shall be as indicated on the drawings and herein specified in the sections of the specifications.
  - 1. Refer to attachment for scope of testing to be provided by Owner.

#### **1.3 TESTING AND INSPECTION CHARGES**

- A. For the following conditions, costs of testing and inspection services shall be paid for by the Contractor, apart from the Testing and Inspection.
  - 1. Costs arising from errors or omissions by the Contractor.
  - 2. Costs of concrete cores, of re-testing materials that fail, and of required identification of materials (mill tests, manufacturers certifications, etc.).
  - 3. Costs of test and inspections required to expedite the Contractors operations.

#### **1.4 EARTHWORK**

- A. The Soils Engineer shall be notified for inspection by the Contractor and shall work in cooperation with the Architect. This inspection shall be made before any excavation is attempted on the site. If any undesirable conditions are encountered during Construction, the Soils Engineer shall be notified so that supplemental recommendations can be made. Tests shall be made to define maximum densities of all compaction work. All densities shall be expressed as a relative compaction, in terms of the maximum dry density obtained in the laboratory. The Soils Engineer shall supervise all engineered fill, and make field tests to insure compliance with the required placement of footings; methods of placing and compacting fills; filter and/or rock fill materials.

#### **1.5 CONCRETE WORK**

- A. Reinforcement shall be positively identified by heat numbers and mill analysis. Otherwise, Contractor shall provide test by qualified laboratory, one test for each 5 tons or fraction thereof, each size and type of reinforcing steel. Cement shall be from tested bins and properly identified at the mixing plant. Contractor shall provide to the testing laboratory, aggregate samples for approval. Testing laboratory shall prepare 3 concrete cylinders for each 25 cubic yards, or fraction thereof placed – 2 cylinders to be tested at 7 days, and 1 cylinder at 28 days. Follow ASTM standards throughout.

#### **1.6 GENERAL TESTS AND INSPECTIONS**

- A. Observe all building code test and inspection requirements. Notify proper State, County and City authorities, for their required inspections.

### **PART 2 PRODUCTS (NOT APPLICABLE)**

### **PART 3 EXECUTION (NOT APPLICABLE)**

**END OF SECTION 014529**

This page intentionally left blank

## SECTION 016000 - PRODUCT REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 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 012500 "Substitution Procedures" for requests for substitutions.
  - 2. Section 014200 "References" for applicable industry standards for products specified.

#### 1.2 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 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.
- C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications.

#### 1.3 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. Architects Action: For comparable products submitted for "Cause", 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 fifteen (15) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later. For comparable products submitted for "Contractor's Convenience", Contractor must submit all information necessary to make a direct comparison to specified product for Architect's review, no additional information may be submitted.
    - a. Form of Approval: As specified in Section 012500 "Substitution 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.

## 1.4 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.

## 1.5 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.

## 1.6 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.
  - 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.
- B. Product Selection Procedures:
  - 1. 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 be considered prior to bidding only.
    - b. Nonrestricted 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.
  - 2. 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 be considered prior to bidding only.
    - b. Nonrestricted 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.
  - 3. 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", 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 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. 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 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for the following:
  - 1. Salvaging nonhazardous demolition waste.
  - 2. Disposing of nonhazardous demolition and construction waste.
- B. Related Requirements:
  - 1. Section 024119 "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.

#### **1.2 DEFINITIONS**

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- D. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- E. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- B. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

#### **1.4 QUALITY ASSURANCE**

- A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
- B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

### **PART 2 - PRODUCTS (NOT USED)**

### **PART 3 - EXECUTION**

#### **3.1 PLAN IMPLEMENTATION**

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
  - 1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."

- B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
- C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
  - 2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

### 3.2 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:
  - 1. Clean salvaged items.
  - 2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
  - 3. Store items in a secure area until installation.
  - 4. Protect items from damage during transport and storage.
  - 5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- B. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:
  - 1. Clean salvaged items.
  - 2. Store items in a secure area until delivery to Owner.
  - 3. Transport items to Owner's storage area designated by Owner.
- C. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.
- D. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
- E. Plumbing Fixtures: Separate by type and size.
- F. Lighting Fixtures: Separate lamps by type and protect from breakage.
- G. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

### 3.3 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
  - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION 017419

## **SECTION 017700 - CLOSEOUT PROCEDURES**

### **PART 1 - GENERAL**

#### **1.1 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 017300 "Execution" for progress cleaning of Project site.
  - 2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
  - 3. Section 017839 "Project Record Documents" for submitting record Drawings and record Product Data.
  - 4. Section 017900 "Demonstration and Training" for requirements for instructing Owner's personnel.

#### **1.2 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.

#### **1.3 CLOSEOUT SUBMITTALS**

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

#### **1.4 MAINTENANCE MATERIAL SUBMITTALS**

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

#### **1.5 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 ten (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, 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 Architect. 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. Obtain Architect's signature for receipt of submittals.
  5. Submit test/adjust/balance records.
  6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of ten (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. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
  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 ten (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.

## 1.6 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.
- 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.

## 1.7 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.

## 1.8 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. Partial Occupancy: Submit properly executed warranties within fifteen (15) days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
  1. General: Provide one (1) electronic copy and one (1) paper copy of warranties.
  2. Bind warranties and bonds in heavy-duty, three-ring, white vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
  3. 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.
  4. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
  5. 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.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

## 1.9 PROJECT CLOSEOUT CHECK LIST

- A. Requirements: Contractor must provide the following prior to the Architect and Construction Manager approving the release of final payment:
  1. Verification that final punch list is complete.
  2. Final Affidavit.
  3. Consent of Surety.
  4. Final Lien Waiver.
  5. Affidavit of compliance with Prevailing Wage requirements.
  6. As-Built drawings applicable to this Contract.
  7. Operation and Maintenance Manuals applicable to this Contract.
  8. Current Insurance Certificate.

## 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.

## 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. Remove tools, construction equipment, machinery, and surplus material from Project site.
    - d. Remove snow and ice to provide safe access to building, as applicable.
    - e. 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.
    - f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    - g. Sweep concrete floors broom clean in unoccupied spaces.
    - h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
    - i. 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.
    - j. Remove labels that are not permanent.
    - k. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
    - l. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
    - m. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
    - n. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
    - o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
    - p. 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 015000 "Temporary Facilities and Controls."

### 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 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

This page intentionally left blank

## **SECTION 017823 - OPERATION AND MAINTENANCE DATA**

### **PART 1 GENERAL**

#### **1.1 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 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

#### **1.2 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.

#### **1.3 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 Commissioning Authority, as applicable, 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. General: Provide one (1) pdf electronic file and one (1) paper copy as follows:
    - a. PDF electronic file: Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.
      - 1) Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
      - 2) Enable inserted reviewer comments on draft submittals.
    - b. Paper copy: Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect, through Construction Manager, will transmit paper copy to Owner upon acceptance.
- C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least thirty (30) days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.
  - 1. Correct or revise each manual to comply with Architect's and, as applicable, Commissioning Authority's comments. Submit copies of each corrected manual within ten (10) days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.

## 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. General: Submit one (1) paper copy and one (1) copy in pdf electronic file format.
- B. 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.
- C. 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 and Installer (if applicable).
  - 6. Name and contact information for Construction Manager.
  - 7. Name and contact information for Architect.
  - 8. Name and contact information for Commissioning Authority, as applicable.
  - 9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
  - 10. Cross-reference to related systems in other operation and maintenance manuals.
- D. 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.
- E. 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.
- F. 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.
- G. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
1. Binders: Heavy-duty, three-ring, white vinyl-covered, post-type binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch 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, and indicate Specification Section number on bottom of spine. 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 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. Flood.
  4. Gas leak.
  5. Water leak.
  6. Power failure.
  7. Water outage.
  8. System, subsystem, or equipment failure.
  9. 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



## **SECTION 017839 - PROJECT RECORD DOCUMENTS**

### **PART 1 GENERAL**

#### **1.1 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 017300 "Execution" for final property survey.
  - 2. Section 017700 "Closeout Procedures" for general closeout procedures.

#### **1.2 CLOSEOUT SUBMITTALS**

- A. General: Final Payment will not be made until Project Record Documents are submitted to, reviewed by and are acceptable to the Architect.
- B. Record Drawings: Comply with the following:
  - 1. Number of Copies: Submit copies of record Drawings as follows:
    - a. Initial Submittal:
      - 1) Submit one paper-copy set(s) of marked-up record 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 one (1) paper-copy set of marked-up record prints.
      - 2) Print each drawing, whether or not changes and additional information were recorded.
- C. Record Specifications: Comply with the following:
  - 1. Initial Submittal:
    - a. Submit one paper-copy set(s) of marked-up record specifications.
    - b. Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
  - 2. Final Submittal:
    - a. Submit PDF electronic files of scanned and marked-up record specifications.
- D. Record Product Data: Submit one (1) paper copy and one (1) annotated PDF electronic file and directory 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.
- E. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit one (1) paper copy and one (1) annotated PDF electronic file and directory of each submittal.
- F. Reports: Submit written report weekly, indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

## PART 2 PRODUCTS

### 2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one (1) 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.
  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. Changes made by Change Order or Construction Change Directive.
    - i. Changes made following Architect's written orders.
    - j. Details not on the original Contract Drawings.
    - k. Field records for variable and concealed conditions.
    - l. 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:
1. 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, as follows:
    - a. Format: Annotated PDF electronic file with comment function enabled.
    - b. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
    - c. Refer instances of uncertainty to Architect for resolution.
    - d. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
      - 1) See Section 013300 "Submittal Procedures" for requirements related to use of Architect's digital data files.
      - 2) Architect will provide data file layer information. Record markups in separate layers.
- C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
  2. Format: Annotated PDF electronic file with comment function enabled.
  3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.

4. 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. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
  5. Note related Change Orders, record Product Data, and record Drawings where applicable.
- B. Format: Refer to previous Article.

## 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 and record Drawings where applicable.
- B. Format: Submit one (1) copy of record Product Data as scanned PDF electronic file(s) of marked-up paper copy of Product Data.
  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 one PDF electronic file and a separate paper copy of marked-up miscellaneous record submittals].
  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 017839

## **SECTION 017900 - DEMONSTRATION AND TRAINING**

### **PART 1 - GENERAL**

#### **1.1 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. Pre-Produced demonstration and training videos.

#### **1.2 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 (pre-produced) demonstration and training video recordings for systems, equipment, and products.
- B. Qualifications: For Instructor.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.

#### **1.3 CLOSEOUT SUBMITTALS**

- A. Pre-Produced Demonstration and Training Video Recordings: Submit two (2) copies within seven days of end of training.
  - 1. Identification: On each copy, provide an applied label with the following information:
    - a. Name of Project.
    - b. Name of Architect.
    - c. Name of Construction Manager.
    - d. Name of Contractor.
    - e. Date of video recording.
    - f. Name and address of videographer.
  - 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. One copy shall be prepared and bound in format matching operation and maintenance manuals, and the second copy shall be in PDF electronic file format on compact disc.

#### **1.4 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. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.
- C. Pre-instruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." 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.

## 1.5 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 and shutdown 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. Coordinate with Owner for number of participants, instruction times and location.
  - 2. Describe system design, operational requirements, criteria and regulatory requirements.
  - 3. Owner will furnish Contractor with names and positions of participants.
    - a. Owner will have in attendance a participant to describe Owner's operational philosophy.
- 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, through Construction Manager, with at least seven (7) days' advance notice.
    - a. Notify Architect in writing of training schedule.

- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- 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. Pre-Produced Video Recordings. Video recordings may be used as a component of each training module. Upon completion of training, furnish to Owner one (1) copy of each video used for training.

END OF SECTION 017900



## **SECTION 024119 - SELECTIVE DEMOLITION**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Demolition and removal of selected portions of building or structure as indicated, and as required to accommodate new construction.
  - 2. Demolition and removal of selected site elements.
- B. Related Requirements:
  - 1. Section 017300 "Execution" for cutting and patching procedures.

#### **1.2 DEFINITIONS**

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

#### **1.3 MATERIALS OWNERSHIP**

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

#### **1.4 PREINSTALLATION MEETINGS**

- A. Predemolition Conference: Conduct conference at Project site.
  - 1. Inspect and discuss condition of construction to be selectively demolished.
  - 2. Review structural load limitations of existing structure.
  - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
  - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
  - 5. Review areas where existing construction is to remain and require protection.

#### **1.5 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For refrigerant recovery technician.

- B. Proposed Protection Measures: Submit report, including Drawings, that indicate the measures proposed for protecting individuals and property, for environmental protection, for dust control and, for noise control. Indicate proposed locations and construction of barriers.
- C. Schedule of Selective Demolition Activities: Indicate the following:
  - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
  - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
  - 3. Coordination for shutoff, capping, and continuation of utility services.
  - 4. Use of elevator and stairs.
  - 5. Coordination of Owner's continuing occupancy of portions of existing building to ensure uninterrupted progress of Owner's on-site operations and of Owner's partial occupancy of completed Work.
- D. Predemolition Photographs or Video: Show existing conditions of adjoining construction, including finish surfaces, that might be misconstrued as damage caused by demolition operations.
- E. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.
  - 1. Prior to commencement of demolition, representatives of the Owner and the Contractor will inspect the project areas where work will be conducted, and designate items to be salvaged. Items to be salvaged shall be identified by tagging/labeling and listed on the inventory.

#### 1.7 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by an EPA-approved certification program.

#### 1.8 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
  - 1. Before selective demolition, Owner will remove the following items:
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
  - 1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
  - 2. Contractor and Owner's forces shall each conduct work according to all applicable OSHA and EPA regulations.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
  - 1. Maintain fire-protection facilities in service during selective demolition operations.

#### 1.9 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding. Existing warranties include the following:

- B. Notify warrantor on completion of selective demolition and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

#### 1.10 COORDINATION

- A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

### PART 2 PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ASSE A10.6 and NFPA 241.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.
- C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate, and measure the nature and extent of conflict. Promptly submit a written report to Architect.

#### 3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
  - 1. Comply with requirements for existing services/systems interruptions specified in Division 01 Section "Summary."
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
  - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
  - 2. Arrange to shut off utilities with utility companies.
  - 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.

#### 3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Comply with requirements for access and protection specified in Section 015000 "Temporary Facilities and Controls."
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
  2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
  3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
  4. Cover and protect furniture, furnishings, and equipment that have not been removed.
  5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 01 Section "Temporary Facilities and Controls."
- C. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
  2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
  3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
  4. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."
- D. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
1. Strengthen or add new supports when required during progress of selective demolition.
- E. Remove temporary barricades and protections where hazards no longer exist.

### 3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
  2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering, and chopping. Temporarily cover openings to remain.
  3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
  5. Maintain adequate ventilation when using cutting torches.
  6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
  7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
  8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  9. Locate temporary wall/knockout panels and remove to extent indicated, minimizing damage to existing adjacent construction to remain.
  10. Dispose of demolished items and materials promptly.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Removed and Salvaged Items:
1. Clean salvaged items.
  2. Pack or crate items after cleaning. Identify contents of containers.
  3. Store items in a secure area until delivery to Owner.

4. Transport items to Owner's storage area designated by Owner.
  5. Protect items from damage during transport and storage.
- D. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
  2. Pack or crate items after cleaning and repairing. Identify contents of containers.
  3. Protect items from damage during transport and storage.
  4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

### 3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

### 3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
1. Do not allow demolished materials to accumulate on-site.
  2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
  3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
  4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.

### 3.7 CLEANING

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

END OF SECTION 024119

This page intentionally left blank

## SECTION 055000 - METAL FABRICATIONS

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Miscellaneous Steel Framing and Supports (055000.A01) for:
    - a. Interior athletic equipment:
    - b. Mechanical and Electrical equipment.
    - c. Steel framing and supports for applications where framing and supports are not specified in other Sections.
  - 2. Shelf angles (055000.A05).
  - 3. Loose bearing and leveling plates (055000.A21) for applications where they are not specified in other Sections.
  - 4. Slotted-channel inserts and ceiling assembly.
- B. Products furnished, but not installed, under this Section include the following:
  - 1. Loose steel lintels (055000.A22).
  - 2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
  - 3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.
- C. Related Requirements:
  - 1. Section 042000 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
  - 2. Section 051200 "Structural Steel Framing" for steel framing, supports, elevator machine beams, hoist beams, divider beams, door frames, and other steel items attached to the structural-steel framing.

#### 1.2 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.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Paint products.
  - 2. Shrinkage-resisting grout.
  - 3. Slotted channel framing.
- 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. Miscellaneous steel framing and supports.
    - a. Steel framing and supports for countertops.
    - b. Steel framing and supports for mechanical and electrical equipment.
    - c. Steel framing and supports for applications where framing and supports are not specified in other Sections.
  - 2. Shelf angles.
  - 3. Metal bollards.

- C. Samples for Verification: For each type and finish of extruded nosing and tread.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Research/Evaluation Reports: For post-installed anchors, from ICC-ES.

#### 1.5 QUALITY ASSURANCE

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

#### 1.6 FIELD CONDITIONS

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

#### 1.7 SEQUENCING

- A. Deliver steel bearing plates to be built into cast-in-place concrete and masonry construction.

### PART 2 PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design the following.
  - 1. Connections to Building Structure.
    - a. Delegated design engineer shall coordinate with structural engineer to design connections to building structure.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

#### 2.2 METALS

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

- C. Steel Channels, Plates, Shapes, and Bars: ASTM A 36/A 36M.
- D. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.
- E. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- F. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- G. Rolled-Stainless-Steel Floor Plate: ASTM A 793.
- H. Abrasive-Surface Floor Plate: Steel plate with abrasive material metallurgically bonded to steel.
- I. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- J. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.
- K. Zinc-Coated Steel Wire Rope: ASTM A741.
  - 1. Wire Rope Fittings: Hot-dip galvanized-steel connectors with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.
- L. Stainless Steel Wire Rope: Wire rope manufactured from stainless steel wire complying with ASTM A492, Type 316.
  - 1. Wire Rope Fittings: Stainless steel connectors, Type 316, with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.
- M. Steel Prestressing Strand: ASTM A416/A416M, Grade 270 (Grade 1860), low-relaxation, seven-wire, with 0.9-lb/sq. ft. (4.39-kg/sq. m) zinc coating.
  - 1. Steel Prestressing Strand Fittings: Hot-dip galvanized-steel anchors and connectors with capability to sustain, without failure, a load equal to minimum breaking strength of steel prestressing strand with which they are used.
- N. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4, and as follows:
  - 1. Size of Channels: 1-5/8 by 1-5/8 inches.
  - 2. Material: Galvanized steel, ASTM A 653/A 653M, with G90 (Z275) coating.
- O. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
- P. Aluminum Plate and Sheet: ASTM B 209, Alloy 6061-T6.
- Q. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.
- R. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- S. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.
- T. Bronze Extrusions: ASTM B455, Alloy UNS No. C38500 (extruded architectural bronze).
- U. Bronze Castings: ASTM B584, Alloy UNS No. C83600 (lead red brass) or UNS No. C84400 (lead semired brass).

## 2.3 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, 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.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.

- C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 (Grade A325M), Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, (ASTM A563M, Class 10S3) heavy-hex carbon-steel nuts; and where indicated, flat washers.
- D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.
- E. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
  - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- F. 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.
- G. 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.
- H. 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, Class Fe/Zn 5, unless otherwise indicated.
  - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.
- I. Slotted-Channel Inserts and Ceiling Assembly: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 1-5/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches 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.
  - 1. Refer to Reflected Ceiling Plans on drawings for locations using this product.

## 2.4 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 099113 "Exterior Painting," Section 099123 Interior Painting," and Section 099600 "High-Performance Coatings."
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
- C. 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.
- D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- E. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- F. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- H. Shrinkage-Resistant 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.

## 2.5 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 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 and contour of welded surface matches that of adjacent surface.
- 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 or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

## 2.6 MISCELLANEOUS FRAMING AND SUPPORTS (055000.A01)

- 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.
  - 3. Galvanize miscellaneous framing and supports for exterior application and where indicated for interior applications.
- C. Galvanize miscellaneous framing and supports where indicated.
- D. Prime miscellaneous framing and supports with zinc-rich primer, if not exposed to view; or primer specified in Section 099600 "High-Performance Coatings" where exposed to view or painted.

## 2.7 SHELF ANGLES (055000.A05)

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
  - 1. Provide mitered and welded units at corners.
  - 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Galvanize shelf angles located in exterior walls.

- D. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

## 2.8 LOOSE STEEL LINTELS (055000.A22)

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.
- D. Prime loose steel lintels located in exterior walls with zinc-rich primer, if not exposed to view; or primer specified in Section 099600 "High-Performance Coatings" where exposed to view or painted.

## 2.9 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.

## 2.10 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.

## 2.11 STEEL 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 steel items 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 zinc-rich primer is 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.

## 2.12 ALUMINUM FINISHES

- A. As-Fabricated Finish: AA-M12.

- B. Clear Anodic Finish: AAMA 611, Class I, AA-M12C22A41.

## 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.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
  - 1. Cast Aluminum: Heavy coat of bituminous paint.
  - 2. Extruded Aluminum: Two coats of clear lacquer.

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

### 3.3 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

### 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 dry film thickness.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint with original paint per this section.
- C. 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

## SECTION 061000 - ROUGH CARPENTRY

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Wood blocking, cants, and nailers (061000.A13)
  - 2. Preservative-treated wood blocking, cants and nailers (061000.A12).
  - 3. Fire-Retardant-Treated Wood blocking and nailers (061000.A16).
  - 4. Wood furring and grounds (061000.A15, 061000.A18).
  - 5. Plywood blocking panels (061000.A19).
  - 6. Fire retardant treated plywood blocking and backing panels (061000.A20).
  - 7. Preservative-treated plywood blocking panels (061000.A22)

#### 1.2 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.
- C. Lumber grading agencies, and the abbreviations used to reference them, include the following:
  - 1. NLGA: National Lumber Grades Authority.
  - 2. SPIB: The Southern Pine Inspection Bureau.
  - 3. WCLIB: West Coast Lumber Inspection Bureau.
  - 4. WWPA: Western Wood Products Association.

#### 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 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.
  - 5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:
  - 1. Wood-preservative-treated wood.
  - 2. Fire-retardant-treated wood.
  - 3. Power-driven fasteners.
  - 4. Post-installed anchors.
  - 5. Expansion anchors and metal framing anchors.

## 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 wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products 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, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber 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. Dress lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 19 percent for 2-inch nominal thickness or less; no limit for more than 2-inch nominal thickness unless otherwise indicated.

### 2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWP A 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 that 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 or omit marking and provide certificates of treatment compliance issued by inspection agency.
- D. Application: Treat items indicated on Drawings, and the following:
  - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
  - 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
  - 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
  - 4. Wood floor plates that are installed over concrete slabs-on-grade.

### 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 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.
  - 4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D 5664 and design value adjustment factors shall be calculated according to ASTM D 6841. For enclosed roof framing, framing in attic spaces, and where high temperature fire-retardant treatment is indicated, provide material with adjustment factors of not less than 0.85 modulus of elasticity and 0.75 for extreme fiber in bending for Project's climatological zone.
- C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
- E. Application: Treat items indicated on Drawings, and the following:
  - 1. Framing for raised platforms and stages.
  - 2. Plywood blocking and backing panels.
  - 3. Roof construction.

## 2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
  - 1. Preservative-treated blocking, grounds and nailers (061000.A12).
  - 2. Blocking, grounds and nailers (061000.A13).
    - a. Blocking for wall-mounted cabinets and casework shall be 2x6, minimum.
  - 3. Curbs and cants (061000.A14).
  - 4. Furring (061000.A15).
  - 5. Fire-retardant treated wood blocking and nailers (061000.A16).
  - 6. Fire-retardant treated wood curbs and cants (061000.A17).
    - a. Rooftop equipment bases and support curbs.
  - 7. Fire-retardant treated wood furring: (061000.A18).
- 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. Spruce-pine-fir; NLGA.
  - 3. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
  - 4. Western woods; WCLIB or WWPA.
- C. Concealed Boards: 19 percent maximum moisture content and any of the following species and grades:
  - 1. Mixed southern pine or southern pine; No. 2 grade; SPIB.
  - 2. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
  - 3. Western woods; WCLIB or WWPA.
- D. 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.
- E. 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.

- F. 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 MISCELLANEOUS PLYWOOD PANELS

- A. General: DOC PS 1, Exposure 1, CD, non-fire-retardant treated and fire-retardant treated as noted below, in thickness indicated or, if not indicated, not less than 5/8-inch nominal thickness.
  - 1. Plywood shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
  - 2. Plywood blocking and backing panels, non-fire-retardant treated (061000.A19).
  - 3. Fire-Retardant-Treated Plywood blocking and backing panels (061000.A20).
    - a. Note that plywood equipment backing panels are specified in Article below.
  - 4. Preservative Treated Plywood blocking and backing panels, non-fire-retardant treated (061000.A22).

## 2.6 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels (061000.A20): Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.
  - 1. Plywood shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.7 FASTENERS

- A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.
  - 1. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
  - 2. Where rough carpentry is preservative treated or fire-retardant-treated wood materials, provide Type 304 stainless steel fasteners or fasteners with corrosion-protective coating have a salt-spray resistance of more than 800 hours according to ASTM B117.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC58 or ICC-ES AC308 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.

## 2.8 MISCELLANEOUS MATERIALS

- A. Flexible Strip Flashing (061000.A24): Provide self-adhering, membrane, 40 mils thick.
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated in the work included, but are not limited to, the following:
    - a. Air-Shield by W. R. Meadows, Inc.
    - b. Blueskin by Henry Corp.
    - c. CCW 705 by Carlisle Coatings & Waterproofing.
    - d. Hyload S/A Through Wall Flashing by Hyload, Inc.
- B. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
  - 1. Adhesives shall have a VOC content of 70 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. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chlorpyrifos as its active ingredient.

## PART 3 EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- C. Install plywood blocking and 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.
- 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 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 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 AWWA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
  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 rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  1. NES NER-272 for power-driven fasteners.
  2. Table 2304.10.1, "Fastening Schedule," in ICC's International Building Code.
  3. 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.
- L. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
  1. Comply with approved fastener patterns where applicable. Before fastening, mark fastener locations, using a template made of sheet metal, plastic, or cardboard.
  2. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.

### 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.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

### 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.
- B. Furring to Receive Plywood: Install 1-by-3-inch nominal-size furring vertically at 16 inches o.c.
- C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal-size furring vertically at 16 inches o.c.

### 3.4 PROTECTION

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

END OF SECTION 061000

## SECTION 079200 - JOINT SEALANTS

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Silicone joint sealants.
  - 2. Urethane joint sealants.
  - 3. Latex joint sealants.
  - 4. Polyurea joint sealants.
  - 5. Hybrid silicone sealants.
  - 6. Polyether Sealants.
- B. Related Sections:
  - 1. Section 078413 "Penetration Firestopping" for sealing penetrations in fire-resistance-rated construction.
  - 2. Section 088000 "Glazing" for glazing sealants.
  - 3. Section 092900 "Gypsum Board" for acoustical sealant and sealing acoustical joints.

#### 1.2 PRECONSTRUCTION TESTING

- A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
  - 1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
  - 2. Conduct field tests for each application indicated below:
    - a. Each kind of sealant and joint substrate in exterior walls.
    - b. Sealant around perimeter of exterior windows/storefront.
  - 3. Notify Architect seven days in advance of dates and times when test joints will be erected.
  - 4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
    - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
      - 1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
  - 5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
  - 6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. 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.
- D. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Preconstruction Field-Adhesion Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
- C. Field-Adhesion Test Reports: For each sealant application tested.
- D. Warranties: Sample of special warranties.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.
- 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.
- D. Preinstallation Conference: Conduct conference at Project site.

#### 1.6 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
  - 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.

#### 1.7 WARRANTY

- A. Special Installer's Warranty: Manufacturer's standard form in which 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's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: 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 structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
  - 2. Disintegration of joint substrates from natural causes exceeding design specifications.
  - 3. Mechanical damage caused by individuals, tools, or other outside agents.
  - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

## PART 2 PRODUCTS

### 2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. VOC Content: Sealants and sealant primers shall comply with the following:
  - 1. Architectural sealants shall have a VOC content of 250 g/L or less.
  - 2. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.
  - 3. Sealants and sealant primers for porous substrates shall have a VOC content of 775 g/L or less.
- C. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- D. Stain-Test-Response Characteristics: Where sealants are specified to be non-staining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- E. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- F. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.
- G. Keynote Designations: Refer to schedule at end of this Section for types and applicable substrates.
  - 1. Sealant: (079200.A01).
  - 2. Sealant with backer rod: (079200.A02).
  - 3. Acoustical sealant: (079200.A04): Refer to Section 092900.
  - 4. Tape Sealant (079200.A05).

### 2.2 SILICONE JOINT SEALANTS

- A. Single-Component, Non-Staining, Non-sag, Ultra Low Modulus, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50 minimum, for Use NT.
  - 1. Products:
    - a. Tremco Incorporated; Spectrem 1.
    - b. Sika; Sikasil WS 290 FPS.
    - c. Dow; Dowsil 756 SMS Building Sealant.
    - d. Pecora; 890NST.
- B. Single-Component, Non-Staining, Non-sag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50 minimum, for Use NT.
  - 1. Products:
    - a. Tremco Incorporated; Spectrem 2.
    - b. Sika; Sikasil WS-295 FPS.
    - c. Dow; Dowsil 756 SMS Building Sealant.
    - d. Pecora; 890NST.
- C. Single-Component, Non-sag, Traffic-Grade, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use T.
  - 1. Products:
    - a. Dow; Dowsil 790 Silicone Building Sealant.
    - b. Sika; Sikasil 728 NS.
    - c. Pecora Corporation; 311 NS.
- D. Mildew-Resistant, Single-Component, Non-sag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25 minimum, for Use NT.

1. Products:
  - a. Tremco Incorporated; Spectrem 2.
  - b. Sika; Sikasil GP.

## 2.3 URETHANE JOINT SEALANTS

- A. Multicomponent, Non-sag, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25 minimum, for Use NT.
  1. Products:
    - a. Sika; Master Seal NP 2.
    - b. Tremco Dymonic 100.
    - c. Sika Products; Sikaflex; 2c NS EZ Mix.
    - d. Pecora Corporation; Dynatrol II.
- B. Multicomponent, Non-sag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25 minimum, for Use T.
  1. Products:
    - a. Sika; Master Seal NP 2.
    - b. Tremco Dymonic 100.
    - c. Sika Products; Sikaflex; 2c NS EZ Mix.
    - d. Pecora Corporation; Dynatrol II.
- C. Multicomponent, Pourable, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade P, Class 25 minimum, for Use T.
  1. Products:
    - a. Sika; Master Seal SL 2.
    - b. Sika; Sikaflex; 2c SL.
    - c. Pecora Corporation; Dynatrol II SG.

## 2.4 LATEX JOINT SEALANTS

- A. Latex Joint Sealant: 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. BASF Building Systems; Sonolac.
    - b. May National Associates, Inc.; Bondaflex Sil-A 700.
    - c. Pecora Corporation; AC-20+.
    - d. Tremco Incorporated; Tremflex 834.

## 2.5 POLYUREA SEALANTS

- A. Polyurea Sealant: Semi-rigid, self-leveling, 2-part type. Shore D hardness of 85 when tested in accordance with ASTM D 2240. Tensile strength of 1160 pounds per square inch when tested in accordance with ASTM D 412.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Curecrete Distribution Company, Inc.; Ashford Crete-Fill.
    - b. L&M Construction Chemical, Inc. Joint Tite 750.
    - c. Adhesives Technologies Corp.; Crackbond JF311.

## 2.6 HYBRID SILICONE SEALANTS FOR RESINOUS WALL TREATMENTS

- A. Basis of Design: Subject to compliance with requirements, provide one of products listed below or a comparable product, with the following product characteristics, submitted to and accepted by Architect.
  1. Products:
    - a. Sika; MasterSeal NP 100.
  2. Product Characteristics:
    - a. Classification: ASTM C920, Type S, Grade NS, Class 50, Use T.
    - b. Movement Capacity: +/- 50 percent.
    - c. Shore A Hardness: 17 to 23 per ASTM C 661.



- d. Tensile Strength: 160-200 psi per ASTM D 412.
- e. Tear Strength 22 lbs. per inch per ASTM 1004.
- f. Color: As selected by Architect from manufacturer's full range of custom options.

## 2.7 POLYETHER SEALANTS

- A. Structural Adhesive/Sealant: ASTM C 920, Type S, Grade NS, Class 35, Use T, NT, M, A, G and O.
  - 1. Basis of Design: M-1 Structural Adhesive/Sealant as manufactured by Chem Link.
  - 2. Product Characteristics:
    - a. Tensile Properties (ASTM D-412) at 21 days: Tensile Stress: 370-psi minimum. Elongation at Break: 525%.
    - b. Shear Strength (ASTM D-1002): 390 psi.
    - c. Shore A Hardness (ASTM D-2240) at 21 days: 45.
    - d. Adhesion in Peel (TT-S-00230C, ASTM C 794).
    - e. Service Range: -40 degree to 200-degree F (-40 degree to 93 degree C).
- B. Siding - Window - Door - Roof Sealant: ASTM C 920, Type S, Grade NS, Class 35, Use T1, NT, M, A, G and O.
  - 1. Basis of Design: DuraLink 35 Sealant as manufactured by Chem Link.
  - 2. Product Characteristics:
    - a. Performance Requirements:
      - 1) Initial Cure (ASTM D-679): 45 minutes
    - b. Properties (ASTM D-412) at 21 days: Tensile Stress - 250-psi minimum. Elongation at Break - 750%. Modulus of 100%: 43 psi (0.30 MPa).
    - c. Shore A Hardness (ASTM D-2240) at 21 days: 20 +/-3
    - d. Service Range: -40 degree to 200-degree F (-40 degree to 93 degree C).
- C. Siding - Window - Door - Roof Sealant: ASTM C 920, Type S, Grade NS, Class 50, Use T1, NT, M, A, G and O.
  - 1. Basis of Design: DuraLink 50 Sealant as manufactured by Chem Link.
    - a. Product Characteristics:
      - 1) Performance Requirements:
        - (a) Initial Cure (ASTM D-679): 45 minutes
      - 2) Properties (ASTM D-412) at 21 days: Tensile Stress - 250-psi minimum. Elongation at Break - 750%. Modulus of 100%: 43 psi (0.30 MPa).
      - 3) Shore A Hardness (ASTM D-2240) at 21 days: 20 +/-3
      - 4) Service Range: -40 degree to 200-degree F (-40 degree to 93 degree C).

## 2.8 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings (079200.A04): 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 (079200.A05): 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: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
  - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
  - 2. Clean, porous joint substrate surfaces by brushing, grinding, 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.
  - 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.
- 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.

4. As sealant work progresses, install tube weeps at 24 inches on center along base of metal wall panels and where indicated.
- D. 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.
- E. Tooling of Non-sag 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 where indicated per Figure 8B in ASTM C 1193.

### 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 one test for the first 1000 feet (300 m) of joint length for each kind of sealant and joint substrate.
  2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
    - 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. Inspect tested joints and report on the following:
    - a. Whether sealants filled joint cavities and are free of voids.
    - b. Whether sealant dimensions and configurations comply with specified requirements.
    - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
  4. 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.
  5. 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 and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

### 3.7 JOINT-SEALANT SCHEDULE (079200.A01)

- A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.
  - 1. Joint Locations:
    - a. Isolation and contraction joints in cast-in-place concrete slabs.
    - b. Joints between different materials listed above.
  - 2. Urethane Joint Sealant: Multicomponent, pourable/non-sag, traffic grade, Class 25.
  - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- B. 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 within and at perimeter of storefront and curtain wall assemblies.
    - d. Control and expansion joints.
    - 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.
  - 2. Silicone Joint Sealant: Single component, non-staining, non-sag, neutral curing, Class 50.
  - 3. Polyether Joint Sealant: 100% solids one-component, gun grade, polyether-base material. The sealant shall cure under the influence of atmospheric moisture to form an elastomeric joint material.
  - 4. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.
  - 1. Joint Locations:
    - a. Isolation joints in cast-in-place concrete slabs.
    - b. Other joints as indicated, except for expansion and control joints.
  - 2. Urethane Joint Sealant: Multicomponent, non-sag, traffic grade, Class 25.
  - 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. Expansion joints in tile and resinous flooring.
  - 2. Silicone Joint Sealant: Single component, non-sag, traffic grade, neutral curing, Class 100/50.
  - 3. Joint Sealant Color: As selected by Architect from manufacturer's full range of colors.
- E. Joint-Sealant Application: Interior control/contraction joints in horizontal traffic surfaces.
  - 1. Joint Locations:
    - a. Control/contraction joints in concrete slabs indicated to receive sealed finish, polished concrete finish, resinous flooring and joints in slabs on grade extending to building exterior, seal watertight.
  - 2. Polyurea Joint Sealant: Polyurea, multi component, self-leveling, traffic grade.
  - 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.
  - 1. Joint Locations:
    - a. Control and expansion joints on exposed interior surfaces of exterior walls.
    - b. Perimeter joints of exterior openings where indicated.
    - c. Vertical joints on exposed surfaces of interior unit masonry and concrete.
  - 2. Joint Sealant: Urethane, multicomponent, non-sag, Class 25, paintable.
  - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- G. Joint Sealant Application: Interior joints in vertical surfaces.
  - 1. Joint Locations:
    - a. Vertical joints in exposed surfaces of gypsum drywall partitions.
    - b. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
  - 2. Joint Sealant: Acrylic based, paintable.
  - 3. Polyether Joint Sealant: 100% solids one-component, gun grade, polyether-base material. The sealant shall cure under the influence of atmospheric moisture to form an elastomeric joint material.
  - 4. Joint Sealant Color: As selected by Architect from manufacturer's full range of colors.

- H. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.
  - 1. Joint Sealant Location:
    - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    - b. Tile control and expansion joints where indicated.
  - 2. Joint Sealant: Single component, non-sag, mildew resistant, acid curing, Silicone.
  - 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.
- I. Joint-Sealant Application: Interior control/contraction joints in vertical surfaces (Resinous Wall treatments)
  - 1. Joint Locations:
    - a. Control and expansion joints in CMU, cement board, or gypsum board indicated to receive resinous wall treatment.
  - 2. Joint Sealant: Hybrid Silicone, single component, non-sag, Class 50, traffic grade.
  - 3. Joint Sealant Color: As selected by Architect from manufacturer's full range of custom colors.

END OF SECTION 079200

This page intentionally left blank

## **SECTION 081113 - HOLLOW METAL DOORS AND FRAMES**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section includes hollow-metal work.
  - 1. Hollow-metal frame (081113.A31).
- B. Related Requirements:
  - 1. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.
  - 2. Section 099123 "Interior Painting" for field painting of hollow-metal work.
  - 3. Section 099600 "High Performance Coatings" for field painting of hollow metal work.
  - 4. Division 26 Sections for electrical connections including conduit and wiring for door controls and operators.

#### **1.2 DEFINITIONS**

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

#### **1.3 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.

#### **1.4 PREINSTALLATION MEETINGS**

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

#### **1.5 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings, and finishes.
- B. Shop Drawings: Include the following:
  - 1. Furnish a schedule of doors and frames using same reference numbers for details and openings as those on Drawings.
  - 2. Elevations of each door type.
  - 3. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
  - 4. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
  - 5. Locations of reinforcement and preparations for hardware.
  - 6. Details of each different wall opening condition.
  - 7. Details of anchorages, joints, field splices, and connections.
  - 8. Details of accessories.
  - 9. Details of moldings, removable stops, and glazing.
  - 10. 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.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.
- B. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

## 1.7 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 non-vented plastic.
  - 1. Provide additional protection to prevent damage to factory-finished units.
  - 2. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- B. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch-high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

## 1.8 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ceco Door Products; an Assa Abloy Group company.
  - 2. Curries Company; an Assa Abloy Group company.
  - 3. Republic Doors and Frames.
  - 4. Steelcraft; an Allegion company.
- B. Source Limitations:
  - 1. Obtain hollow-metal work from single source from single manufacturer.

### 2.2 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits 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. For areas required to receive a fire rating greater than 45 minutes, fire testing shall be based on fire resistive criteria according to NFPA 251 or ASTM E119.
- B. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.
  - 1. For areas required to receive a fire rating of 45 minutes or greater, fire testing shall be based on fire resistive criteria according to NFPA 251 or ASTM E119.



## 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. Heavy-Duty Frames: SDI A250.8, Level 2.
  - 1. Physical Performance: Level B according to SDI A250.4.
  - 2. Frames (081113.A31):
    - a. Materials: Uncoated, steel sheet, minimum thickness of 0.067 inch (14 gauge).
      - 1) Provide metallic-coated cold rolled steel in areas exposed to moisture and as indicated on Drawings.
    - b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
    - c. Construction: Face welded.
    - d. Reinforcement: Provide high frequency hinge reinforcement at top hinge location.
  - 3. Vision Lites:
    - a. For non-fire-rated glass, provide the following:
      - 1) Manufacturer's "flush" type vision lights.
  - 4. Exposed Finish: Prime.

## 2.4 FRAME ANCHORS

- A. Jamb Anchors:
  - 1. General: Anchors for severe storm-resistant door and frame assemblies shall be of sufficient length to provide not less than 5 inches of embedment into adjacent wall construction at jamb.
  - 2. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
  - 3. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
  - 4. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
  - 5. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:
  - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

## 2.5 MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- C. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z 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. 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 hollow-metal frames of type indicated.
- F. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.
- G. 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.

- H. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

## 2.6 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 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. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
  - 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. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
  - 5. Jamb Anchors: Provide number and spacing of anchors as follows:
    - a. Masonry Type: Locate anchors not more than 16 inches from top and bottom of frame. Space anchors not more than 32 inches o.c., to match coursing, and as follows:
      - 1) Two anchors per jamb up to 60 inches high.
      - 2) Three anchors per jamb from 60 to 90 inches high.
      - 3) Four anchors per jamb from 90 to 120 inches high.
      - 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
    - b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      - 1) Three anchors per jamb up to 60 inches high.
      - 2) Four anchors per jamb from 60 to 90 inches high.
      - 3) Five anchors per jamb from 90 to 96 inches high.
      - 4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
    - c. Compression Type: Not less than two anchors in each frame.
    - d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
  - 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.
- C. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- D. 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.
  - 3. Provide high frequency hinge reinforcement on top hinge only (two additional 10 gauge reinforcements are welded at 3 places each) on all door frames.
- E. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted hairline joints.
  - 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
  - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
  - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
  - 4. Vision lights shall be "flush" type, without through-bolts.

5. Provide loose stops and moldings on inside of hollow-metal work.
6. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

## 2.7 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.

## 2.8 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inch 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. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- 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. 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.
- C. Provide high frequency hinge reinforcement on top hinge only (two additional 10 gauge reinforcements are welded at 3 places each) on all door frames.
- D. Reinforce doors and frames to receive continuous hinges where scheduled.

### 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, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 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 frames with removable stops located on secure side of opening.
    - d. Install door silencers in frames before grouting.

- 1) Provide mortar guards for hinge and strike plate cutouts and any electrical components attached to frames.
- e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
- f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
- g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
  - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
5. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
  - a. At STC-rated door and frames, fill cavity of frame with mineral wool insulation sufficiently to achieve STC ratings indicated prior to door installation.
7. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
  - a. At STC-rated door and frames, fill cavity of frame with mineral wool insulation sufficiently to achieve STC ratings indicated prior to door installation.
8. 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, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
  - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
  - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
  - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.
  1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

### 3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including 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.

END OF SECTION 081113

## **SECTION 081416 - FLUSH WOOD DOORS**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Solid-core doors with wood-veneer faces (081416.A01 – A1, B1).
  - 2. Factory finishing flush wood doors.
  - 3. Factory fitting flush wood doors to frames and factory machining for hardware.
- B. Related Requirements:
  - 1. Section 081113 "Hollow Metal Doors and Frames" for hollow metal frames.
  - 2. Section 087100 "Door Hardware" for hardware in flush wood doors.
  - 3. Section 088000 "Glazing" for glass view panels in flush wood doors.
  - 4. Section 099123 "Interior Painting" for field finishing doors.

#### **1.2 PREINSTALLATION MEETINGS**

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

#### **1.3 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
  - 1. Factory finished doors.
- D. Samples for Verification:
  - 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish.
    - a. 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. Frames for light openings, 6 inches long, for each material, type, and finish required.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Sample Warranty: For special warranty.
- B. Certificates: For door manufacturer as set forth in Quality Assurance article.

## 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is a certified participant in AWI's Quality Certification Program. Note that project will not be AWI Certified.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on bottom rail with opening number used on Shop Drawings.

## 1.7 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 temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during remainder of construction period.

## 1.8 WARRANTY

- 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 in a 42-by-84-inch section.
    - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch 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 / Marshfield / Mohawk / Masonite Architectural Doors
  - 2. Eggers Industries.
  - 3. Graham Wood Doors; an Assa Abloy Group company.
  - 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 WDMA I.S.1-A, "Architectural Wood Flush Doors."
  - 1. Provide 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. WDMA I.S.1-A Performance Grade:
  - 1. Extra Heavy Duty.

- C. 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.
  - 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
  - 2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
  - 3. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
  - 4. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
  - 5. 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.
- D. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.
- E. Particleboard-Core Doors:
  - 1. Particleboard: ANSI A208.1, Grade LD-2.
    - a. Provide with binder containing no urea-formaldehyde
  - 2. Blocking: Provide wood blocking in particleboard-core doors as follows:
    - a. 5-inch top-rail blocking, in doors indicated to have closers.
    - b. 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
  - 3. Provide doors with structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.
- F. Structural-Composite-Lumber-Core Doors:
  - 1. Structural Composite Lumber: WDMA I.S.10.
    - a. Screw Withdrawal, Face: 700 lbf.
    - b. Screw Withdrawal, Edge: 400 lbf.
- G. 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 as follows:
    - a. 5-inch top-rail blocking.
    - b. 5-inch bottom-rail blocking, in doors indicated to have protection plates.
    - c. 5-inch midrail blocking, in doors indicated to have armor plates.
    - d. 5-inch 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 per WDMA T.M.-10.

### 2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Solid-Core Doors (081416.A01 – A1, B1):
  - 1. Grade: Premium, with Grade A faces.
  - 2. Species:
    - a. Match species of existing wood doors at each location as determined by Architect and Owner from manufacturer's full range of options.
  - 3. Cut:
    - a. Plain sliced (flat sliced).
  - 4. Match between Veneer Leaves:
    - a. Book match.
    - b. Match veneer matching of existing doors at project site.
  - 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. Exposed Vertical and Top Edges: Same species as faces - edge Type A.

- a. Stile edges shall be 2-ply, not less than 1-3/8 inch thick. Outer hardwood edge ply shall be 5/8 inch thick. Inner ply shall be structural composite lumber or hardwood. Stile edges shall be continuous and shall not be finger jointed.
- 8. Core: Particleboard or structural composite lumber.
- 9. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.
  - a. MDF cross bands are not acceptable.
- 10. Color:
  - a. Match color of existing wood doors at each location as determined by Architect and Owner from manufacturer's full range of options.

## 2.4 LIGHT FRAMES AND LOUVERS

- A. General: Light frames are to match light frames in existing doors for each school. Contractor shall field verify material type and profile for light frames.
- B. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
  - 1. Wood Species: Same species as door faces.
  - 2. Profile: Manufacturer's standard shape to match existing.
  - 3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.
- C. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

## 2.5 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.
- C. Openings: Factory cut and trim openings through doors.
  - 1. Light Openings: Trim openings with moldings of material and profile indicated.
  - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."
  - 3. Louvers: Factory install louvers in prepared openings.

## 2.6 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 two faces, two vertical edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.
    - a. Where top edge is visible from an upper level (occupiable space) top edge shall be finished.
- B. Factory finish doors that are indicated to receive transparent finish.
- C. Transparent Finish:
  - 1. General: Intent is to match Architect's control sample.
  - 2. Grade: Premium.
  - 3. Finish: Provide one of the following finishes:
    - a. AWI's "Architectural Woodwork Standards" System 10, UV curable, water based polyurethane.



- b. WDMA TR-6 catalyzed polyurethane.
  - 4. Staining: Custom, to match Architect's control sample.
  - 5. Effect: Semifilled finish, produced by applying an additional finish coat to partially fill the wood pores.
  - 6. Sheen: Satin.
- D. Opaque Finish: Refer to Section 099123 "Interior Painting" and Section 099600 "High Performance Coatings" for painting of flush wood doors.

## 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.
  - 3. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch 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 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 at lock and hinge edges.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- 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

This page intentionally left blank

## SECTION 087100 – DOOR HARDWARE

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Intent: The intent of this Section is to provide finish hardware for the proper operation and control of all wood, hollow metal and aluminum doors in the Project. Prior to bidding, notify the Architect of any doors that do not have hardware meeting this intention.
- B. This Section includes items known commercially as finish or door hardware that are required for swinging doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed. This Section includes, but is not necessarily limited to furnishing and installing complete, the following:
  - 1. Finish hardware for proper operation and control of all wood, aluminum and hollow metal doors, including hinges, locks and latch sets, closers, panic devices, auto-flushbolts, electric strikes, magnetic holders, removable mullions, cylinders, keys, miscellaneous stops, flat goods, weatherstripping and thresholds as required.
  - 2. Cylinder for access doors where specified.
- C. Related work in other sections:
  - 1. Hollow metal doors, frames and silencers: Section 081113.
  - 2. Wood doors: Section 081416.
  - 3. Aluminum doors: Section 084113.

#### 1.2 DEFINITIONS

- A. "Finish Hardware" includes items known commercially as finish hardware which are required for swing, and folding doors, except special types of unique and non-matching hardware specified in the same section as the door and door frame.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: Submit manufacturers technical product data for each hardware item. Include information necessary to show compliance with requirements and include instructions for installation and for maintenance of operating parts and finishes.
  - 1. Manufacturer shall submit written certification confirming closers compliance with U.L. 10C.
- B. Hardware Schedule: Submit a hardware schedule in a vertical format (horizontal format not acceptable), organized into sets, including the information below. Designations for door numbers and hardware sets in the schedule shall match those used in the Construction Documents for each opening.
  - 1. Hardware Schedule shall be coordinated with doors, frames, and related work to ensure proper size, thickness, hand function, and finish of door hardware.
  - 2. Catalog cuts of each type of exposed hardware unit, highlighted in color to indicate compliance with the Hardware Schedule.
  - 3. Type, style, function, size and finish of each hardware item.
  - 4. Name and manufacturer of each item.
  - 5. Fastenings and other pertinent information.
  - 6. Explanation of all abbreviations, symbols, codes, etc., contained in schedule.
  - 7. Mounting locations for hardware.
  - 8. Door and frame sizes and materials.
  - 9. Deviations from Specifications shall be noted in cover letter.
- C. Submittal Sequence: Submit schedule at earliest possible date particularly where acceptance of hardware schedule must precede fabrication of other work (e.g., hollow metal frames) which is critical in the project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by finish hardware, and other information essential to the coordinated review of hardware schedule.
- D. Keying Schedule: Submit separate detailed schedule, at the same time as the Hardware Schedule, indicating keying for all locks and how Owner's instructions, on keying of locks has been fulfilled. Keying schedule must be approved before ordering any locks.

- E. Pinning Transcript: Submit detailed schedule indicating each lock cylinder and core.
- F. Templates: Furnish hardware templates to each fabricator of doors, frames and other work to be factory-prepared for the installation of hardware. Upon request, check shop drawings of such other work, to confirm that adequate provisions are made for proper location and installation of hardware.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturer: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements.
- B. Product/Material Qualifications: Manufacturer's product numbers are indicated for convenience in identifying finish hardware items. Unless otherwise indicated, manufacturer's description for indicated product number constitutes minimum standards of quality, design, function and performance required for each item to be incorporated into the Project.
  - 1. It will be the responsibility of the Bidder to furnish with his Bid a list clarifying any deviations from these specifications written or implied, in order that a fair and proper evaluation be made. Those Bidders not submitting a list of deviations will be presumed to have Bid as specified.
- C. Supplier Qualifications: A recognized Architectural Finish Hardware Supplier, with warehousing facilities, who has been furnishing hardware in the project's vicinity for a period of not less than 2 years. Supplier shall be or employ an experienced Architectural Hardware Consultant (AHC) who is certified by and member of the Door and Hardware Institute. The Architectural Hardware Consultant shall be available, at reasonable times during the course of the work, for consultation about project's hardware requirements, to Owner, Architect and Contractor.
  - 1. Supplier shall meet with the Owner to finalize keying requirements and obtain final instructions in writing.
- D. Fire-Rated Openings: Provide hardware for fire-rated openings in compliance with NFPA Pamphlets No. 80, No. 101 and of authorities having jurisdiction requirements. Provide only hardware which has been tested and listed by UL, FM or Warnock Hersey for types and sizes of doors required and complies with requirements of door and door frame labels.
  - 1. Where emergency exit devices are required on fire-rated doors, (with supplementary marking on doors' UL or FM labels indicating "Fire Door to be Equipped with Fire Exit Hardware") provide UL or FM label on exit devices indicating "Fire Exit Hardware".
- E. Standards: Comply with the requirements of the latest edition of the following standards, unless indicated otherwise:
  - 1. American National Standards Institute (ANSI) Publications:
    - 1. A115 Series - Door and Frame Preparation.
    - 2. A156 Series - Hardware.
  - 2. Builders Hardware Manufacturers Association (BHMA) Publications:
    - 1. 1201 - Auxiliary Hardware.
    - 2. 1301 - Materials and Finishes.
  - 3. Door and Hardware Institute (DHI) Publications:
    - 1. Keying - Procedures, Systems, and Nomenclature.
    - 2. Abbreviations and Symbols.
    - 3. Hardware for Labeled Fire Doors.
    - 4. Recommended Locations for Builder's Hardware for Standard and Custom Steel Doors and Frames.
    - 5. Wood Door Standards W1, W2, WDHS-2, WDHS-3.
  - 4. National Fire Protection Association (NFPA) Publications:
    - 1. NFPA Pamphlet No. 80 - Standards for Fire Doors and Windows.
  - 5. International Building Code - current edition adopted.
  - 6. Americans with Disabilities Act (ADA).
- F. Keying Conference: Conduct conference in accordance with Section 013100. In addition to Owner, Construction Manager, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
  - 1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
  - 2. Preliminary key system schematic diagram.
  - 3. Requirements for key control system.

4. Address for delivery of keys.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Section 013100 as follows:

1. Architectural Finish Hardware supplier (AFHS) shall conduct the preinstallation conference at the site. The AFHS shall instruct finish hardware installer on proper installation, adjustment and troubleshooting for each operable item of finish hardware specified. The AFHS shall observe the installation and adjustment of the first three locksets, closers and exit devices.

#### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Package each hardware item in separate containers with all screws, wrenches, installation instructions and installation templates. Mark or tag each box with hardware heading and door number according to approved hardware schedule.
- B. Packaging of door hardware is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in same container.
- C. Deliver individually packaged hardware items at the proper times to the proper locations (shop or project site) for installation. Provide a complete packing list showing items, door numbers and hardware headings with each shipment.
- D. Store hardware in shipping cartons above ground and under cover to prevent damage.
  1. Provide secure lockup for door hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items that are not immediately replaceable so that completion of the Work will not be delayed by hardware losses both before and after installation.
- E. Aluminum Door Hardware: If required by door manufacturer deliver hardware for aluminum doors as directed by the door supplier for factory installation.

#### 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 door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- B. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to power supplies, fire alarm system and detection devices, access control system, security system, and building control system, as applicable.

#### 1.7 MAINTENANCE

- 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 HARDWARE - GENERAL

- A. Provide the materials or products indicated by trade names, manufacturer's name, or catalog number.
- B. Provide manufacturer's standard products meeting the design intent of this Specifications, free of imperfections affecting appearance or serviceability.
  1. Base Metals: Produce hardware units of basic metal and forming method indicated using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units for finish designations indicated.

2. Provide hardware complete with all fasteners, anchors, instructions, layout templates, and any specialized tools as required for satisfactory installation and adjustment.
  3. Hand of door: Drawings show direction of slide, swing or hand of each door leaf. Furnish each item of hardware for proper installation and operation of door movement as shown.
  4. Furnish screws for installation, with each hardware item. Provide Phillips flat-head screws except as otherwise indicated or approved. Finish screws exposed under any condition to match hardware finish or, if exposed in surfaces of other work, to match finish of such other work as closely as
  5. Finish all other hardware in accordance with the BHMA finish as follows, unless otherwise indicated in manufacturers screws to secure hardware.
  6. Provide concealed fasteners for hardware units which are exposed when door is closed, except to extent no standard units of type specified are available with concealed fasteners. Do not use thru-bolts for installation where bolt head or nut on opposite face is exposed in other work, except where indicated otherwise or where it is not feasible to adequately reinforce the work. In such cases, provide sleeves for each thru-bolt or use sex bolt fasteners.
  7. Provide factory pinned cylinders and cores.
- C. Hardware is specified in the hardware schedule by set, type, and functions which have been selected as best meeting the application requirements. Acceptable products for each category are specified under PART 2 of this Specification.

## 2.2 SPECIAL REQUIREMENTS

- A. Hinges:
1. Provide non-removable pins for all exterior doors and out-swinging corridor doors. Use nonrising pins for all other doors.
  2. Pre-drill pilot holes for hinge fasteners at factory to suit hinge type.
  3. Provide continuous hinges where specified.
- B. Locksets:
1. Locksets shall meet or exceed ANSI A156.13-94, Grade 1 requirements.
- C. Panic Devices:
1. All panic devices shall have touchbars made of stainless steel, provide devices in stainless finish where specified.
  2. All latchbolts are to be deadlatching.
  3. Panic devices shall be through-bolted, using sex bolt fasteners.
  4. Exit devices are to incorporate a flush and tapered end cap.
  5. Hardware mullions are to be of the same manufacturer as the panic device. Provide keyed mullions unless otherwise specified. Provide mullion storage kits where specified.
  6. Except on fire-rated doors, or unless specified otherwise, provide panic devices with hex key dogging device to hold latch bolt open on doors with closers.
  7. Devices incorporating plastic dogging components will not be allowed.
  8. Provide electrical options as specified.
- D. Closers:
1. Comply with manufacturer's recommendations for unit size based on door size, weather exposure and usage.
  2. Through-bolt all closer units, using sex bolt fasteners.
  3. Provide parallel arms for all overhead closers, except as otherwise indicated.
  4. All surface closers shall exceed ANSI A156.4 Grade 1 requirements in all aspects as called for below. All closers shall have certification by an independent testing laboratory of 10,000,000 cycles without failure. Provide special rust inhibitive primer (SRI) where specified.
  5. Furnish all brackets, drop plates and any other necessary hardware required to insure proper installation.
- E. Stops
1. Provide heavy duty and concealed or surface mounted overhead stop or holder for interior doors as specified. Provide overhead stop for interior doors that swing more than opens against equipment, casework, sidelights, and where conditions do not allow wall stop.
- F. Thresholds and Gasketing
1. Provide thresholds, weatherstripping (including door sweeps, seals, astragals) and gasketing systems (including smoke, sound, and light) as specified and per architectural details. Match finish of other items.

2. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.
3. Gasketing and astragals on aluminum frames by door manufacturer.

G. Silencers

1. Provide "push-in" type silencers for hollow metal or wood frames.
2. Provide one silencer per 30 inches of height on each single frame, and two for each pair frame.
3. Omit where gasketing is specified.

## 2.3 KEYING

- A. Standard Lock Cylinders: BHMA A156.5; Grade 1 cylinders; face finished to match lockset.
- B. Key all locks separately, or alike, as directed by the Owner's representative and Architect. Provide keys as follows:
  1. Change Keys: Two (2) per lock.
  2. Master Keys: Six (6) required (per system).
- C. Existing Key System: Key cylinders to Owners existing master key system.
- D. All exterior doors to be keyed to Schlage Primus, interior doors to match existing keyway.
- E. Provide Schlage cylinders with large format interchangeable construction cores on all exterior openings.

## 2.4 KEY CONTROL SYSTEM

- A. Fire Department Access Boxes:
  1. Provide key lock boxes designed for storage of 2-5 keys. Manufactured by Knox Company or equal.
  2. Provide one lock box at exterior and provide one near elevators, if applicable.
  3. Locate in accordance with architectural detail. Where not specifically indicated, locate as directed by Architect.
  4. Provide surface mounted or recessed based on direction from Architect.

## 2.5 HARDWARE FINISHES

- A. Provide matching finishes for hardware units at each door to the greatest extent possible, unless otherwise indicated. In general, match items to the finish for the latch, lock or push-pull unit for color and texture.
  1. Product description or schedule:
    - 1) 626 satin chrome-plated.
    - 2) 630 satin stainless steel.

## 2.6 HARDWARE PRODUCTS

- A. Hinges:
  1. Specified manufacturer: IVES Hardware; an Allegion Company.
  2. Acceptable substitutions:
    1. Hager Companies.
    2. McKinney Products Company; an ASSA ABLOY Group company.
    3. Stanley Commercial Hardware; Div. of The Stanley Works.
- B. Continuous Gear-Type Hinges:
  1. Specified manufacturer: IVES Hardware; an Allegion Company.
  2. Acceptable substitutions:
    1. Hager Companies.
    2. McKinney Products Company; an ASSA ABLOY Group company.
    3. Select Products Limited.
- C. Locksets:
  1. Specified manufacturer: Schlage Commercial Lock Division; an Allegion Company.
  2. Substitutions: Not allowed. Products to match District standard.
- D. Exit Devices:
  1. Specified manufacturer: Von Duprin; an Allegion Company

2. Substitutions: Not allowed. Products to match District standard.
- E. Closers:
  1. Specified manufacturer: LCN Closers; an Allegion Company.
  2. Substitutions: Not allowed. Products to match District standard.
- F. Flatgoods:
  1. Specified manufacturer: Ives Hardware; an Allegion Company.
  2. Acceptable substitutions:
    1. Burns.
    2. Rockwood.
- G. Stops:
  1. Specified manufacturer: Ives Hardware; an Allegion Company.
  2. Acceptable substitutions:
    1. Burns Manufacturing Incorporated.
    2. Hager Companies.
    3. Rockwood Manufacturing Company.
    4. Trimco
- H. Overhead stops:
  1. Specified manufacturer: Glynn-Johnson; an Allegion Company.
  2. Acceptable substitutions:
    1. Architectural Builders Hardware Mfg., Inc.
    2. Door Controls International.
    3. Ives Hardware; an Allegion Company.
    4. Rixson Specialty Door Controls; an ASSA ABLOY Group.
- I. Thresholds:
  1. Specified manufacturer: Zero International
  2. Acceptable substitutions:
    1. Pemko Manufacturing Co.
    2. Reese Enterprises.
    3. National Guard Products.
- J. Door Gasketing/Weatherstripping:
  1. Specified manufacturer: Zero International
  2. Acceptable substitutions:
    1. Pemko Manufacturing Co.
    2. Reese Enterprises.
    3. National Guard Products.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Carefully inspect doors, frames, and conditions under which hardware will be installed. Notify the Architect of any conditions that would adversely affect the installation or subsequent door operations. Do not proceed until unsatisfactory conditions are corrected.
  1. Frames shall be verified, inspected, and confirmed by General Contractor as being plumb and true.
- B. Refer to Sections 081113, 081416, and 084113 for additional installation requirements.
- C. Prior to hardware installation, the Hardware Supplier shall meet with the Owner's Representative, Architect, and Hardware Installer to ensure the Installer has and understands the manufacturers' installation requirements for all hardware items.
  1. The Supplier shall observe the installation of the first lockset, closer and panic device.

### 3.2 INSTALLATION

- A. Mount Hardware units at heights indicated in respective DHI Standards, except as specifically indicated or required to comply with governing regulations, and except as may be otherwise directed by Architect.



- B. Install each hardware item in compliance with the manufacturer's instructions and written recommendations. Wherever cutting and fitting is required to install hardware onto or into surfaces which are later to be field finished, coordinate removal, storage and reinstallation or application of surface protections with finishing work. Do not install surface-mounted items until finishes have been completed on the substrate.
- C. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
  - 1. Special care shall be taken to avoid damaging surrounding surfaces.
- D. Provide fasteners and anchoring devices of suitable size, quantity, and type to secure hardware in proper position for heavy use and long life.
  - 1. Drill and countersink units which are not factory-prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.
- E. Adjust door closers immediately upon installation. Adjust in exact conformance with manufacturer's printed instructions. Advance backcheck to eliminate shock at dead stop. Set latching speed to assure unassisted positive latching.
  - 1. Degrees of swing of doors for self-limiting closers shall be maximum available.
- F. Install each protection plate with a thinly-spread spot of mastic at its center to assure even contact before fastening with screws. Install all such plates on visual centers of closed doors. Set bottom edges of all such plates flush with door bottom.
- G. Cut and fit thresholds to door frame profiles. Prepare thresholds for the attachment of strikes and clearance for spindles as required. Set thresholds in a continuously laid bed of polyisobutylene mastic sealant to completely fill voids and exclude moisture from every source.
- H. Seal weather protection components attached to the exterior sides of doors and frames, such as drip caps and weatherstripping, in place with clear silicone caulk in such a manner as to ensure a continuously filled seam throughout the joinery.
- I. Cut and fit weatherstripping accurately to provide the greatest possible continuity of the contact element. Adjust closer templating as required.
- J. At exterior doors, obtain satisfactory operation of the installation, then apply a thin layer of clear silicone caulk under hinge leaves, and outside lock trim. Remove excess caulk after torqueing fasteners.

### 3.3 ADJUST AND CLEAN

- A. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly as intended for the application made.
  - 1. Clean adjacent surfaces soiled by hardware installation.
- B. Final Adjustment: Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy, and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.

### 3.4 INSTRUCTION AND INSPECTION

- A. Instruct Owner's Personnel in proper adjustment and maintenance of hardware and hardware finishes, during the final adjustment of hardware.
- B. After hardware is installed and adjusted, the Supplier shall inspect the job with the Architect and the Contractor to determine if the hardware is functioning properly.
  - 1. Maintain the instruction sheets, layout templates, and any supplementary literature regarding hardware in a readable condition. Transmit all such items to the Owner's Representative, together with all spare parts, specialized tools, other accessories supplied with the hardware, and a copy of the approved hardware schedule at the time of instruction.
- C. Continued Maintenance Service: Approximately six months after the acceptance of hardware in each area, the Installer, accompanied by the representative of the latch and lock manufacturer, shall return to the project and re-adjust every item of hardware to restore proper function of doors and hardware. Consult

with and instruct Owner's personnel in recommended additions to the maintenance procedures. Replace hardware items which have deteriorated or failed due to faulty design, materials or installation of hardware units at no cost to the Owner. Prepare a written report of current and predictable problems (of substantial nature) in the performance of the hardware.

#### HARDWARE SETS

##### HARDWARE SET: 01

##### DOOR NUMBER:

A104                      A105

##### EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	CLASSROOM LOCK	ND70LD RHO	626	SCH
1	EA	K-I-L CYLINDER	23-065	626	SCH
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

##### HARDWARE SET: 02

##### DOOR NUMBER:

A102

##### EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
3	EA	HINGE	5BB1HW 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	ND10S RHO	626	SCH
1	EA	SURFACE CLOSER	4040XP HW/PA	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
1	EA	WALL STOP	WS406/407CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

##### HARDWARE SET: 03

##### DOOR NUMBER:

A103

##### EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CONT. HINGE	224XY	628	IVE
1	EA	PULL PLATE	8303 10" 4" X 16" (PUSH SIDE)	630	IVE
1	EA	FLUSH PULL	919 (PULL SIDE)	626	IVE
1	EA	SURFACE CLOSER	4040XP HEDA	689	LCN
1	EA	KICK PLATE	8400 8" X 2" LDW B-CS	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HARDWARE SET: 04

DOOR NUMBER:

A101B

EACH TO HAVE:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	MAGNETIC LOCK	M490P 12/24 VDC	628	SCE
1	EA	POWER SUPPLY	BY OWNER		
1	EA	NOTE	CARD ACCESS BY OTHERS		
1			EXISTING DOOR, FRAME AND HARDWARE TO REMAIN		

NOTE: REWIRE EXISTING CARD READER TO UNLOCK MAGNETIC LOCK AND ELECTRIC STRIKE AFTER VALID CARD READ. ADD INTERIOR READER. MODIFY EXISTING HARDWARE AS REQUIRED.

OPERATION: DOOR NORMALLY CLOSED AND LOCKED FROM BOTH SIDES. ACCESS VIA VALID CARD READ. NOT AN EXIT.

**END OF SECTION 087100**



## **SECTION 088000 - GLAZING**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section includes:
  - 1. Glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
    - a. Doors.
  - 2. Glazing sealants and accessories.
  - 3. Glass types include:
    - a. Fully Tempered Monolithic Float Glass.
    - b. Specialty/Decorative Glass.
      - 1) Decorative Film Overlay.
- B. Related Requirements:
  - 1. Section 081416 "Flush Wood Doors" for vision light glass in flush wood doors.

#### **1.2 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.
- D. Interspace: Space between lites of an insulating-glass units.

#### **1.3 COORDINATION**

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

#### **1.4 REFERENCES**

- A. American Society for Testing and Materials (ASTM):
  - 1. ASTM E 119: Fire Tests of Building Construction and Materials.
- B. American National Standards Institute (ANSI):
  - 1. ANSI Z97.1: Standard for Safety Glazing Materials Used in Buildings.
- C. Consumer Product Safety Commission (CPSC):
  - 1. CPSC 16 CFR 1201: Safety Standard for Architectural Glazing Materials, Category II.

#### **1.5 PREINSTALLATION MEETINGS**

- A. Pre-installation 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.
  - 3. Review drawings for locations and details of glazing.

## 1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
  - 1. Testing will not be required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
  - 2. Use ASTM C 1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
  - 3. Test no fewer than eight Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
  - 4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
  - 5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including the use of specially formulated primers.

## 1.7 ACTION SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square. Submit the samples listing glass type corresponding to Glass Legend indicated on Drawings and as follows:
  - 1. Specialty Glass.
    - a. Decorative Film Overlay.
      - 1) Glazing Film Overlay Samples: Submit colored manufacturer's standard sample sets showing full range of colors available for each type and color indicated.
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- D. 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.

## 1.8 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For the following:
  - 1. Installers.
  - 2. Glass testing agency.
  - 3. Sealant testing agency.
- B. Product Certificates: For each type of glass and glazing product, from manufacturer. For glass.
- C. Product Test Reports: For 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.

## 1.9 CLOSEOUT SUBMITTALS

- A. Warranties: Sample of special warranties.

## 1.10 QUALITY ASSURANCE

- A. Manufacturer Qualifications for Insulating-Glass Units with Low-E Coatings: A qualified insulating-glass manufacturer who is approved and certified by coated-glass manufacturer.

- B. 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.
- C. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
- D. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- E. Safety Glazing Labeling: Where safety glazing labeling is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

#### 1.11 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.
- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

#### 1.12 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.
- B. Environmental Limitations for Fire Glazing: Do not deliver or install fire-resistant glazing until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature conditions at occupancy levels during the remainder of the construction period.

#### 1.13 WARRANTY

- A. Special Warranty for Glazing Film Overlay: Manufacturer's standard form in which glazing film manufacturer agrees to replace glazing film units that deteriorate within specified warranty period. Deterioration of glazing film is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning glazing film 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 for Glazing Films: Five years from date of Substantial Completion.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type
  - 1. Obtain decorative glazing film overlay from single source from single manufacturer for each product and installation method.
- 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 to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- C. 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 6 mm thick.
  - 2. U-Factors: Center-of-glazing values, according to NFRC 100 and based on LBL's WINDOW 5.2 computer program, expressed as Btu/sq. ft. x h x deg F.
  - 3. Solar Heat-Gain Coefficient and Visible Transmittance: Center-of-glazing values, according to NFRC 200 and based on LBL's WINDOW 5.2 computer program.
  - 4. Visible Reflectance: Center-of-glazing values, according to NFRC 300.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

## 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: "Glazing Manual."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the Safety Glazing Certification Council (SGCC) or another certification agency acceptable to authorities having jurisdiction or manufacturer. 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 lites in thicknesses as needed to comply with requirements indicated.
  - 1. Minimum Glass Thickness for Exterior Lites: 6.0 mm, except where specifically indicated otherwise.
- D. Strength:
  - 1. Where float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article.
  - 2. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article.
  - 3. Where fully tempered float glass is indicated, provide fully tempered float glass.

## 2.4 GLASS PRODUCTS

- A. Fully-Tempered Monolithic 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. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- B. Glass Types: Refer to Glass Type Schedules at end of this Section.

## 2.5 SPECIALTY / DECORATIVE GLAZING

- A. Glazing Film Overlay (088000.A93): Glass with decorative adhesive-backed colored film overlay. Use dimensionally stable, optically clear polyester film with UV stable, pressure-sensitive, clear adhesive back for



adhering to glass and releasable protective backing.

- B. Glass Types: Refer to Glass Type Schedules at end of this Section.

## 2.6 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
1. EPDM complying with ASTM C 864.
  2. Silicone complying with ASTM C 1115.
- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned EPDM or silicone gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.
1. Application: Use where soft compression gaskets will be compressed by inserting dense compression gaskets on opposite side of glazing or pressure applied by means of pressure-glazing stops on opposite side of glazing.

## 2.7 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. Provide glazing sealants that are compatible with glazing products and each other and are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.
  3. 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.
  4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
- C. Glazing Sealants for Fire-Rated Glazing Products: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated.
1. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

## 2.8 GLAZING TAPES

- A. General: Provide glazing tapes that are compatible with glazing products and each other and are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.
- B. 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 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
  2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- C. 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.

## 2.9 MISCELLANEOUS GLAZING MATERIALS

- A. General:
  - 1. 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.
  - 2. Provide glazing gaskets, glazing sealants, glazing tapes, setting blocks, spacers, edge blocks, and other glazing accessories that are compatible with glazing products and each other and are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.
- 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.

## 2.10 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, ambient; 180 deg F, 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.
  - 1. Provide ground and polished edges for glass doors and shelving at display cases.
  - 2. Provide ground and polished edges for glass shelving at merchandising walls.

## 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. Minimum required bite.
  - 5. 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.
  - 1. Use methods approved by testing agencies that listed and labeled fire-resistive glazing or fire-protective glazing products.
- B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- C. 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.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- E. 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.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches.
  - 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 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.
- H. 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.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- 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 GLAZING FILM OVERLAY INSTALLATION

- A. General: Comply with glazing film manufacturer's written instructions for preparation and installation.
  - 1. Apply squarely aligned to glass edges, uniformly smooth, and free from tears, air bubbles, wrinkles, and rough edges completely overlaying the back face of clean glass.
  - 2. Install film continuously in longest practicable lengths. Install with no gaps and no overlaps.
  - 3. If seamed, install with no gaps and no overlaps. Install seams vertical and plumb. Horizontal seams are not allowed.
  - 4. Delay removal of release liner from film until just before each piece of film is cut and ready for installation.
  - 5. Install film with mounting solution and custom cut to glass with neat, square corners and edges tight to window frame.
  - 6. Remove air bubbles, wrinkles, blisters and other defects, banding, thin spots and pinholes.
    - a. Where installed film does not meet this criteria, it shall be removed and replaced with new film.

### 3.8 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. 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; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. 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.
- F. Remove excess glazing film mounting solution at finished seams, perimeter edges and adjacent surfaces. Use cleaning methods recommended by glazing film manufacturer. Remove and replace films that cannot be cleaned.

### 3.9 HEAT TREATED MONOLITHIC GLASS SCHEDULE

- A. Glass Type 11 - Clear Fully Tempered monolithic float glass (088000.A11):
  - 1. 1/4 inch (6 mm).
  - 2. Visible Light Transmittance: 85 percent minimum.
  - 3. Provide safety glazing labeling.

### 3.10 SPECIALTY / DECORATIVE GLAZING

- A. Glazing Film Overlay (088000.A93): Glass with decorative adhesive-backed colored film overlay. Use dimensionally stable, optically clear polyester film with UV stable, pressure-sensitive, clear adhesive back for adhering to glass and releasable protective backing.
  - 1. Basis-of-Design Products: Subject to compliance with requirements, provide 3M.; "Fasara"; or a comparable substitute product submitted to and accepted by Architect prior to bidding.
    - a. Substitutions for convenience will not be considered after bidding.
  - 2. Film Finish: Frost/Matte - Opaque White (SH2MAOW).
  - 3. Film Thickness: 142 microns.
  - 4. Product Description: Single or multi-layered decorative film products, applied to interior glass surfaces, consisting of (from outboard surface to inboard surface):
    - a. Removable release liner.
    - b. Pressure sensitive adhesive with integral ultraviolet absorbers.
    - c. Dyed or printed pattern layer of polyester film.
  - 5. Use: Suitable for interior applications.
  - 6. Accessories: Provide accessories complying with glazing film manufacturer's requirements for application indicated, with proven record of compatibility with surfaces contacted.
    - a. Adhesives: Pressure sensitive acrylic adhesive system.
    - b. Cleaners, Primers and Sealers: Types recommended by glazing film manufacturer.
- B. Spall-Resistant Film: Composite of clear polyvinyl butyral film and clear abrasion-resistant polyester film.
  - 1. Laminating Process: Factory laminate spall-resistant film to glazing assemblies to produce laminated lites free of foreign substances, air, and glass pockets.

END OF SECTION 088000

This page intentionally left blank

## SECTION 092116 - NON-STRUCTURAL METAL FRAMING

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Non-load-bearing steel framing systems for interior partitions (092116.A01).
  - 2. Suspension systems for interior ceilings, bulkheads, soffits, and exterior soffits.
    - a. For spans exceeding 8 feet in any direction refer to Section 054000 for design requirements.
- B. Related Requirements:
  - 1. Section 092900 "Gypsum Board" for gypsum board wall assemblies.

#### 1.2 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."

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association or the Steel Stud Manufacturers Association.
- B. 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 or where not specifically indicated, as specified below, according to ASTM E 119 by an independent testing agency acceptable to authorities having jurisdiction.
  - 1. Provide fire-resistance-rated assemblies identical to those specified by reference to design designations in UL "Fire Resistance Directory" or in listing of other testing and agencies acceptable to authorities having jurisdiction. Design designation from UL are minimum requirements. Where more stringent requirements are indicated or specified, the more stringent requirements shall take precedence.
    - a. One Hour non-load bearing partitions: UL U 465.
    - b. Two Hour non-load bearing partitions: UL U 411.
- B. Horizontal Deflection: For wall assemblies, limited to 1/360 of the wall height based on horizontal loading of 5 lbf/sq. ft..

#### 2.2 FRAMING SYSTEMS

- A. 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 or coating with equivalent corrosion resistance of ASTM A 653/A 653M, G40, hot-dip galvanized unless otherwise indicated.

- B. Studs and Runners (092116.A01): ASTM C 645. Use either steel studs and runners or embossed steel studs and runners.
  - 1. Steel Studs and Runners:
    - a. Minimum Base-Metal Thickness: 0.0296 inch.
    - b. Provide 0.0296 inch minimum base metal thickness for studs and runners at walls indicated to receive tile, walls indicated to receive abrasion-resistant drywall, impact-resistant drywall, and at other locations indicated.
    - c. Depth: 3-5/8 inches, unless otherwise indicated.
  - 2. Embossed Steel Studs and Runners:
    - a. Minimum Base-Metal Thickness: 0.0147 inch.
    - b. Provide 0.025 inch minimum base metal thickness for studs and runners at walls indicated to receive tile, walls indicated to receive abrasion-resistant drywall, impact-resistant drywall, and at other locations indicated.
    - c. Depth: 3-5/8 inches, unless specifically indicated otherwise.
- C. Slip-Type Head Joints: Where indicated, provide one of the following:
  - 1. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit over inside runner and one gauge heavier than gauge for wall construction indicated.
- D. 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.
- E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
  - 1. Minimum Base-Metal Thickness: 0.0296 inch.
- F. Furring Channels (Furring Members) (09216.A03):
  - 1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
- G. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-metal thickness, with minimum 1/2-inch-wide flanges.
  - 1. Depth: 1-1/2 inches.
  - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.
- H. Hat-Shaped, Rigid Furring Channels (092116.A02): ASTM C 645.
  - 1. Minimum Base-Metal Thickness: 0.0179 inch.
  - 2. Depth: 7/8 inch, unless specifically indicated otherwise.
- I. Z-Shaped Furring (092116.A04): With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

## 2.3 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. Vertical Isolation Strips 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.
- C. Isolation Strips beneath Runner Tracks at Exterior Walls: Provide the following:
  - 1. Polyethylene-sheet-backed rubberized asphalt membrane, 40 mils thick. Field cut to match widths of runners.



## 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 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 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.
  - 1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
  - 2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
  - 3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.
- 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. Where runner tracks for exterior walls are installed directly against concrete or dissimilar metals, install rubberized asphalt isolation strips between bottom of runner track and concrete.
- D. Install studs so flanges within framing system point in same direction.

- E. 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, having a minimum base metal thickness of 0.0296 inches, at each jamb.
    - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch 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.
- F. Direct Furring:
1. Screw to wood framing.
  2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- G. 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 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 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 from corner and cut insulation to fit.
- H. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

END OF SECTION 092116

## SECTION 092900 - GYPSUM BOARD

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Interior gypsum board.
    - a. Gypsum Board, Type X (092900.A02).
    - b. Impact-Resistant Gypsum Board (092900.A05).
    - c. Mold-Resistant Gypsum Board (092900.A06).
  - 2. Tile backing panels (092900.A10).
  - 3. Sound attenuation blankets (092900.A14).
- B. Related Requirements:
  - 1. Section 092116 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.
  - 2. Division 26 Sections for electrical connections to lighting components within trim pieces.

#### 1.2 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-long length for each trim accessory indicated.
- C. Samples for Verification: For the following products:
  - 1. Trim Accessories: Full-size Sample in 12-inch-long length for each trim accessory indicated.

#### 1.3 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.

#### 1.4 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.

## 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. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
  - 1. American Gypsum.
  - 2. CertainTeed Corp.
  - 3. Lafarge North America, Inc.
  - 4. National Gypsum Company.
  - 5. USG Corporation.
- B. Gypsum Board, Type X (092900.A02): ASTM C 1396/C 1396M.
  - 1. Thickness: 5/8 inch.
  - 2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
- C. Impact-Resistant Gypsum Board (092900.A05): ASTM C 1629/C 1629M.
  - 1. Core: 5/8 inch, Type X.
  - 2. Long Edges: Tapered.
  - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
  - 4. Physical Properties when tested in accordance with ASTM C 1629:
    - a. Surface Abrasion Resistance: Level 3.
    - b. Indentation Resistance: Level 1, minimum.
    - c. Soft-Body Impact Resistance: Level 3.
    - d. Hard-Body Impact Resistance: Level 3.
- D. Mold-Resistant Gypsum Board (092900.A06): ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
  - 1. Core: 5/8 inch, Type X.
  - 2. Long Edges: Tapered.
  - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

## 2.4 TILE BACKING PANELS

- A. Cementitious Backer Units (092900.A10): ANSI A118.9 and ASTM C 1288 or ASTM C 1325, with manufacturer's standard edges.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide one of the following products or a comparable product, with the following product characteristics, submitted to and accepted by Architect prior to bidding.
    - a. C-Cure.; C-Cure Board 990
    - b. National Gypsum Company.; Permabase Cement Board.
    - c. USG Corporation.; DUROCK Cement Board.
  - 2. Thickness: 5/8 inch.
  - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

## 2.5 TRIM ACCESSORIES

- A. Interior Trim (092900.A11): ASTM C 1047.
  - 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
    - a. At Contractor's option, interior trim may be a structural laminate drywall corner system using "No-Coat" products as manufactured by CertainTeed or a comparable product submitted to and accepted by Architect prior to bidding.
  - 2. Shapes:
    - a. Cornerbead.

- b. L-Bead: L-shaped; exposed long flange receives joint compound.
- c. J-Bead: J-shaped; exposed short flange does not receive joint compound.
- d. Expansion (control) joint.
- e. Wall end cap: Provide "Fast Cap" as manufactured by Trim-Tex Drywall Products.

## 2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
  - 1. Interior Gypsum Board: Paper.
  - 2. Tile Backing Panels: As recommended by panel manufacturer.
  - 3. Cementitious Backer Units: As recommended by backer unit 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, rounded or beveled panel edges, 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.
  - 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.
    - a. Where specifically indicated on Drawings, provide a setting-type, sandable topping compound for trowel-applied skim coat.
- D. Joint Compound for Tile Backing Panels:
  - 1. Cementitious Backer Units: As recommended by backer unit manufacturer.

## 2.7 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. Laminating adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Laminating 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 thick.
  - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."
- E. Sound-Attenuation Blankets (092900.A14): 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.
  - 2. Recycled Content of Blankets: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

## 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 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. 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-wide joints to install sealant.
  - 4. Where ceilings in showers abut adjacent walls, Provide 1/4- to 3/8-inch-wide spaces and trim edges with plastic edge trim to allow for sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-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. 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. Type X: Vertical and horizontal surfaces of walls, soffits, bulkheads and ceiling surfaces unless otherwise indicated.
  - 2. Impact-Resistant Type: Refer to Drawings for locations required.
  - 3. Tile Backing Panels: Restroom walls indicated to receive tile.
  - 4. Moisture and Mold Resistant Type X: Exterior walls and restrooms, except at walls indicated to receive tile. Restrooms and wet walls (such as behind electric drinking fountains, behind janitor's sink and sinks).

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 vertically (parallel 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.
  - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
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 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.

### 3.4 APPLYING TILE BACKING PANELS

A. Cementitious Backer Units: ANSI A108.11

1. Locations:
  - a. At shower ceiling locations and vertical surfaces indicated to receive tile
  - b. At showers, tubs, and where indicated
  - c. At locations indicated to receive tile.

B. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

### 3.5 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.
2. L-Bead: Use where indicated.
3. U-Bead: Use at exposed panel edges.

D. Interior Trim – Structural Laminate: Provide at all outside corners within 8'-0" of floor surface.

E. Aluminum Trim: Install in locations indicated on Drawings.

### 3.6 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, rounded or beveled edges, 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 4: At panel surfaces that will be exposed to view unless otherwise indicated.
    - a. Primer and its application to surfaces are specified in other Division 09 Sections.
  - 3. Level 5:
    - a. Provide at the following locations:
      - 1) At walls perpendicular to exterior glazing.
      - 2) Down Light / Wall Washers
      - 3) Where indicated on Drawings.
    - b. Primer and its application to surfaces are specified in Other Division 09 Sections.
- E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

### 3.7 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 093000 - TILING**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Ceramic and Porcelain tile (093000.A01).
  - 2. Waterproof membrane.
  - 3. Crack isolation membrane.
  - 4. Metal edge strips (093000.A04).
- 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 tile backer units.

#### **1.2 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, ANSI A108.17, 108.18, 108.19, 108.20, A118, A136 which are contained in its "Specifications for Installation of Ceramic Tile."
- C. ANSI A 137.1, American National Standard Specifications for Ceramic Tile.
- D. ANSI A 137.2, American National Standard Specifications for Glass Tile.
- E. ANSI A 37.3, American National Standards Specifications for Gauged Porcelain Tile and Gauged Porcelain Tile Panel/Slabs.
- F. Face Size: Actual tile size, excluding spacer lugs.
- G. Module Size: Actual tile size plus joint width indicated.

#### **1.3 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.

#### **1.4 PERFORMANCE REQUIREMENTS**

- A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
  - 1. Level Surfaces: Minimum 0.60.

#### **1.5 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. 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.
  - 1. Show extent and locations for waterproof membrane and crack isolation membrane.

- C. Samples for Initial Selection: For tile, grout, and accessories involving color selection.
- D. Samples for Verification:
  - 1. Full-size units of each type and composition of tile and for each color and finish required.
  - 2. Full-size units of each type of trim and accessory for each color and finish required.
  - 3. Metal edge strips in 6-inch 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 one unopened box, but not more than 2 percent, for each type, composition, color, pattern, and size indicated.

#### 1.8 QUALITY ASSURANCE

- A. Source Limitations for Tile: Obtain tile of each type and color or finish from one 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 one manufacturer and each aggregate from one source or producer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
  - 1. Crack isolation membrane.
  - 2. Joint sealants.
  - 3. Metal edge strips.
- D. 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.
- 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 of each type of wall tile installation.
  - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- F. Mockups/Field Samples: Build mockups/field samples to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Build mockups/field samples of each type of **restroom wall tile installation**. Mockup/field sample shall extend to floor to demonstrate transition from wall to floor.
  - 2. Build mockups/field samples of each type of wall tile installation.

3. Approved mockups/field samples 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 liquid materials in unopened containers and protected from freezing.
- D. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

## 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 PERFORMANCE REQUIREMENTS

- A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
  1. Level Surfaces: Minimum 0.60.
- B. Dynamic Coefficient of Friction: for tile installed on walkway surfaces, provide product with the following values as determined by testing identical products per ANSI A137.1.
  1. Level Surfaces: Minimum 0.42.

### 2.2 MANUFACTURERS

- A. Source Limitations for Tile: Obtain tile of each type 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. Metal edge strips.

### 2.3 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.
  2. Dynamic coefficient of Friction (DCOF) for Floor Tile: Greater than or equal to 0.42 per ANSI A137.1.

- 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.
- D. Factory-Applied Temporary Protective Coating: Where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by pre-coating with continuous film of petroleum paraffin wax, applied hot. Do not coat unexposed tile surfaces.

## 2.4 CERAMIC AND PORCELAIN TILE PRODUCTS

- A. Tile Type (093000.A01 – **T1**):
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Daltile; Color Wheel Collection - "Linear"
    - a. Comparable products from other manufacturer's, meeting specified requirements, colors and shape, will be considered when submitted to and accepted by Architect prior to bidding.
  - 2. Composition: Glazed ceramic tile.
  - 3. Shape: Rectangle.
  - 4. Size: 4 inch by 12 inch
  - 5. Thickness: 5/16 inch.
  - 6. Tile Color and Pattern: As indicated by manufacturer's designations on Material Finish Legend.
  - 7. Grout Color: As selected by Architect from manufacturers full range.
  - 8. Performance Characteristics:
    - a. Water Absorption: ASTM C 373, <20%.
    - b. Breaking Strength: ASTM C 648, 120-230 lbs.
    - c. Scratch Hardness: MOHS, 4.0 - 6.0.
    - d. Chemical Resistance: ASTM C 650, Resistant.
  - 9. Metal Cove Trim:
    - a. Provide Schluter "Jolly" trim as indicated in Paragraph 2.8.C of this section.

## 2.5 WATERPROOF MEMBRANE AND CRACK ISOLATION MEMBRANE (093000.A03)

- A. Fluid-Applied Waterproofing/Crack Isolation Membrane: Liquid-latex rubber or elastomeric polymer.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Laticrete; "Hydro Ban" waterproofing and crack isolation membrane. Comparable products from other manufacturers will be considered when submitted to and accepted by Architect prior to bidding.
  - 2. Product Description and Characteristics:
    - a. Single component, self-curing liquid rubber polymer that forms a flexible and seamless membrane.
      - 1) Meets ANSI A118.10 - Membranes / Water Proofing and ANSI A118.12 - Membranes / Crack Isolation.
    - b. Thickness: Not less than 0.020 inches when cured.
    - c. Anti-fracture protection up to 1/8 inch.
    - d. Extra Heavy Service rating per TCNA.
  - 3. Adhesives shall have a VOC content of 65 g/L or less.
  - 4. 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."

## 2.6 SETTING MATERIALS

- A. Improved Modified Dry-Set Mortar (Thinset and LHT Mortars): ANSI A118.15.
  - 1. Provide prepackaged, dry-mortar mix containing dry, redispersable, vinyl acetate or acrylic additive to which only water must be added at Project site.
  - 2. For large & heavy tile (LHT) use mortar meeting LHT requirements.

3. For wall applications, provide mortar that complies with requirements for non-sagging mortar in addition to the other requirements in ANSI A118.15.
- B. Water-Cleanable, Tile-Setting Epoxy: ANSI A118.3.
1. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 and 212 deg F, respectively, and certified by manufacturer for intended use.

## 2.7 GROUT MATERIALS

- A. Water-Cleanable High Performance Epoxy Grout: ANSI A118.3, with a working time not less than 80 minutes, equipped with anti-microbial technology and a full cure time of 14 days at 70 degrees F, and with a VOC content of 65 g/L or less. "
1. Basis-of-Design Product: LATICRETE International, Inc., "Spectralock PRO Grout ", or comparable product from other manufacturers listed below, meeting specified requirements, submitted to and accepted by Architect prior to bidding.
    - a. Ardex.
    - b. Bostik, Inc.
    - c. Custom Building Products.
    - d. MAPEI Corporation, "Keraflex Plus"
    - e. Mer-Kote Products, Inc.
    - f. Southern Grouts & Mortars, Inc.
    - g. Summitville Tiles, Inc.
    - h. TEC; a subsidiary of H. B. Fuller Company.
  2. Provide product capable of withstanding continuous and intermittent exposure to temperatures of up to 140 deg. F. and 212 deg. F., respectively, and certified by manufacturer for intended use.
  3. Grout Color: Refer to Material Finish Legend.

## 2.8 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. Rapid Set Pre-Tiling Mortar: mortar shall be designed for both interior and exterior use and shall be non-sag type.
1. Basis-of-Design Product: Ardex; "AM 100 Rapid Set" or comparable product submitted to and accepted by Architect prior to bidding.
  2. Locations for Use: Provide as a ¼ inch thick leveling mortar over interior concrete unit masonry walls indicated to receive tile.
- C. Metal Edge Strips (093000.A04): Profile as specified below, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring and wall applications; white zinc alloy or Type 316 L stainless-steel, ASTM A 666, 300 Series exposed-edge material. Provide Schluter profiles as follows:
1. TypeTR1: Schluter; "Jolly" satin anodized aluminum straight-edge profile for tile edges transitioning to another material.
- 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. Grout Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

## 2.9 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 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.
    - c. Verify that protruding edges of concrete masonry units have been ground smooth and flush with plane of wall.
  - 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. 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.
- C. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, pre-coat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

### 3.3 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 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. Jointing Pattern: Lay tile in stacked grid pattern, unless otherwise indicated. Lay tile in a straight stacked pattern unless indicated otherwise on Drawings. 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.
- E. Joint Widths: Unless otherwise indicated, install tile with joint widths as recommended by the manufacturer.
- F. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
  - 1. Terminate top of wainscot decorative metal edge trim.
- G. All tile terminations that do not end in a corner will be capped with a metal edge trim.
- 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 tile. Do not saw-cut joints after installing tiles.
  - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
  - 2. Prepare joints and apply sealants to comply with requirements in Section 079200 "Joint Sealants."
- I. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated.
- J. Grout Sealer: Apply grout sealer to cementitious grout joints in the wainscot according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

### 3.4 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.
  - 1. Allow waterproofing to cure and verify by testing that it is watertight before installing tile or setting materials over it.

### 3.5 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.
  - 1. Allow crack isolation membrane to cure before installing tile or setting materials over it.

### 3.6 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. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.

### 3.7 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.
  - 1. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- B. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

### 3.8 INTERIOR TILE INSTALLATION SCHEDULE

- A. Interior Wall Installation (Wet Walls), Masonry or Concrete:
  - 1. Tile Installation: Thin-set mortar; TCNA W202I-18., or LHT mortar on cementitious backer unit; TCNA W202I-18.
    - a. Thin-Set Mortar: Latex-portland cement mortar.
    - b. Grout: Water-cleanable epoxy grout.
- B. Interior Wall Installations (Wet Walls), Metal Studs or Furring:
  - 1. Tile Installation: Thin-set mortar; TCNA W202I-18., or LHT mortar on cementitious backer unit; TCNA W202I-18.
    - a. Thin-Set Mortar: Latex-portland cement mortar over liquid waterproofing.
    - b. Grout: Water-cleanable epoxy grout.

END OF SECTION 093000



## **SECTION 095113 - ACOUSTICAL PANEL CEILINGS**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section includes:
  - 1. Acoustical ceiling panels (095113.A01).
  - 2. Ceiling suspension systems (095113.A02).
  - 3. Edge Molding and Trim (095113.A03).
- B. Related Requirements:
  - 1. Division 26 Sections for electrical requirements.

#### **1.2 PRE-INSTALLATION MEETINGS**

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

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified.
- C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
  - 1. Acoustical Panel: One 6 inch square Sample of each type, color, pattern, and texture.

#### **1.4 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. Installer Qualifications: Submit written certification of compliance with requirements.
- C. Qualification Data: For testing agency.
- D. Evaluation Reports: For each acoustical panel ceiling suspension system, from ICC-ES.
- E. Product test reports.
- F. Field quality-control reports.

## 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in maintenance manuals.

## 1.6 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: Furnish two, unopened boxes of each type 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.
  - 5. Single Tee Adapter Clips: Equal to 2 percent of quantity installed.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Firm with not less than three years of successful experience in installation of acoustical ceilings similar to requirements for this project and which is acceptable to manufacturer of acoustical units, as shown by current written statement from manufacturer.
- B. Pre-installation Conference: Conduct conference at Project site to comply with requirements of Section 01 31 00.
- C. Testing Agency Qualifications: Qualified according to NVLAP.

## 1.8 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.

## 1.9 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.
  - 1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

## PART 2 PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. 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."
- 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.

## 2.2 ACOUSTICAL PANEL CEILINGS, GENERAL

- A. Source Limitations:
  1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
  2. Suspension System: Obtain each type 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 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.
- E. Metal Suspension System Standard: Comply with ASTM C 635.

## 2.3 ACOUSTICAL PANELS (095113.A01)

- A. Recycled Content for Acoustical Panels: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product specified hereinafter or comparable product, meeting specified requirements, by one of the following:
  1. Acoustical Ceiling Units:
    - a. Armstrong World Industries, Inc.
    - b. Certainteed, Saint-Gobain.
    - c. USG Interiors, Inc.; Subsidiary of USG Corporation.
  2. Metal Suspension Systems, Edge Moldings and Decorative Edge Trim:
    - a. Armstrong World Industries, Inc.
    - b. Certainteed, Saint-Gobain.
    - c. Chicago Metallic Corporation.
    - d. Gordon, Inc.
    - e. USG Interiors, Inc.; Subsidiary of USG Corporation.
- C. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as specified.
- D. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

## 2.4 ACOUSTICAL CEILING PANELS

- A. Acoustical Ceiling Panels, (095113.A01 – **CLG1**): Provide humidity resistant, square lay-in, mineral fiber ceiling panels with the following characteristics:
  1. ASTM E 1264 Classification: Type III, Form 2, Pattern C, E.
  2. Sizes: 24 inch by 48 inch by 5/8 inch
  3. Color: Refer to Material Finish Legend.
  4. Average light reflectance (LR): 0.83,
  5. Noise reduction coefficient (NRC): 0.55.
  6. Ceiling attenuation class (CAC): 35.

7. Articulation class (AC): N/A
8. Flame Spread/Fire Resistance: Class A.
9. Humidity Resistance: N/A.
10. Product warranty: 30 years.
11. Suspension System: 15/16.
12. Basis of Design Product: Provide USG; "Radar Basic Panel No. 2310".

## 2.5 METAL SUSPENSION SYSTEMS, GENERAL

- A. Recycled Content for Suspension Grid: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 60 percent.
- B. 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.
- C. 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: Post-installed expansion 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.
  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.
- D. 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. 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, provide not less than 0.106-inch-diameter wire.
- E. Hanger Rods and Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.
- F. Hold-Down Clips for Non-Fire-Resistance-Rated Ceilings: For vestibule and corridor ceilings adjacent to exterior doors, provide hold-down clips spaced 2'-0" o.c. on all cross-tees for a radius of 10 feet from center of door.
- G. Impact Clips: In all toilet provide manufacturer's standard impact clip system design to absorb impact forces against lay-in panels.
- H. Hemmed Edge Molding: Provide prefinished edge molding of profiles indicated. Finish to match adjacent suspension grid.
- I. Fixture Trim: Provide manufacturer's standard fixture trim for fixtures within the 4 by 4 ceiling panels.
  1. Color to match suspension trim.

## 2.6 METAL SUSPENSION SYSTEM (095113.A02)

- A. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; pre-painted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than G30 coating designation; with prefinished 15/16-inch- wide metal caps on flanges.
  1. Structural Classification: Intermediate-duty system.
  2. End Condition of Cross Runners: Override (stepped) or butt-edge type.
  3. Face Design: Flat, flush.
  4. Cap Material: Steel cold-rolled sheet, except in kitchen and food preparation areas provide aluminum.

5. Cap Finish: As indicated on Material Finish Legend.
6. Basis of Design:
  - a. Profile: USG "DX/DXL" as indicated on Material Finish Legend.

## 2.7 METAL EDGE MOLDINGS AND TRIM (095113.A03)

- 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.

## 2.8 ACOUSTICAL SEALANT

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  1. Acoustical Sealant for Concealed Joints:
    - a. Henkel Corporation; OSI Pro-Series SC-175 Acoustical Sound Sealant.
    - b. Pecora Corporation; AIS-919.
    - c. Tremco, Inc.; Tremco Acoustical Sealant.
- B. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
  1. Concealed Joints: Nondrying, non-hardening, non-skinning, non-staining, gunnable, synthetic-rubber sealant.

## PART 3 EXECUTION

### 3.1 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.

### 3.2 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.

### 3.3 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. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
  6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, post-installed mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
  7. 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.
  8. Do not attach hangers to steel deck tabs.
  9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
  11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. 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.
1. Arrange directionally patterned acoustical panels as indicated on reflected ceiling plans.
- D. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or post-installed anchors.
- E. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. At areas indicated, 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 o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
  3. Do not use exposed fasteners, including pop rivets, on moldings and trim, unless acceptable to Architect.
- F. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- G. 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. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
  4. Hold-Down Clips for Non-Fire-Resistance-Rated Ceilings: For vestibule ceilings adjacent to exterior doors, provide hold-down clips spaced 2'-0" o.c. on all cross-tees for a radius of 10 feet from center of door.
  5. Impact Clips: In all toilet and locker rooms, provide manufacturer's standard impact clip system design to absorb impact forces against lay-in panels.

### 3.4 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

This page intentionally left blank



## **SECTION 096513 - RESILIENT BASE AND ACCESSORIES**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Resilient base (096513.A01).
  - 2. Resilient molding accessories (096513.A06).
  - 3. Metal transition strips.

#### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Samples for Initial Selection: For each type of product indicated.
- C. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturers' standard-size Samples, but not less than 12 inches long.

#### **1.3 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 for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

#### **1.4 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 or more than 90 deg F.

#### **1.5 FIELD CONDITIONS**

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 65 deg F or more than 95 deg F, 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, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

#### **1.6 WARRANTY**

- A. Special Limited Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace resilient base and accessories that fails within specified warranty period.
  - 1. Material warranty direct from the product manufacture and not a separate or third party insurance provider.
  - 2. Failures include, but are not limited to, the following
    - a. Material manufacturing defects.
    - b. Surface wear and deterioration to the point of wear-through.

- c. Failure due to substrate moisture exposure not exceeding 5 pounds moisture vapor emission rate when tested according to ASTM F 1869, and 80 percent relative humidity when tested according to ASTM F 2170.
- 3. Warranty Period:
  - a. For materials: 5 years from date of Substantial Completion.

## PART 2 PRODUCTS

### 2.1 THERMOSET-RUBBER BASE (096513.A01 - **RB1**)

- A. Basis-of-Design Product: Subject to compliance with requirements, Roppe: "Pinnacle Rubber Wall Base" or comparable product from one of the following:
  - 1. Johnsonite Corporation.
  - 2. Kentile.
  - 3. Mercer Plastics Co, Inc.
  - 4. R.C. Musson Rubber Co.
  - 5. Tarkett.
- B. Product Standard: ASTM F 1861, Type TS (rubber, thermoset).
  - 1. Group: 1 (solid, homogeneous).
  - 2. Style: As indicated on Material Finish Legend.
- C. Product Characteristics:
  - 1. Thickness: 0.125 inch.
  - 2. Height: 4 inches as indicated on Drawings.
    - a. Type "RBX": 4 inches as indicated on Drawings.
  - 3. Lengths: Coils in manufacturer's standard length.
  - 4. Outside Corners: Pre-formed.
  - 5. Inside Corners: Job formed.
  - 6. Colors: As indicated by manufacturer's designations on the Material Finish Legend.

### 2.2 RUBBER MOLDING ACCESSORY (096513.A06)

- A. Description: Reducer strips for carpet to resilient flooring transitions, nosing for carpet, nosing for resilient flooring, joiner for tile and carpet, and transition strips.
- B. Locations: Provide rubber molding accessories in areas indicated.
- C. Colors and Patterns: As indicated by manufacturer's designations on Material Finish Legend.
- D.

### 2.3 METAL TRANSITION STRIPS

- A. Metal Transition Strips: Refer to details on drawings and Sheet A681 for manufacturers and types.
- B. ADA compliant. Maximum slope 1:2.
- C. Locations: Provide molding accessories and transitions in areas indicated.
- D. Colors and Patterns: As selected by Architect from manufacturer's full range.

### 2.4 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 suitable for substrate conditions indicated.
  - 1. Adhesives shall have a VOC content of 50 g/L or less.

## 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. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until they are the same temperature as the space where they are to be installed.
- D. 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. Job-Formed Corners:
  - 1. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches 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 METAL TRANSITION STRIP INSTALLATION

- A. Install metal transition strips where indicated. Securely anchor in place with mechanical fasteners as recommended by transition strip manufacturer.

### 3.6 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. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

## **SECTION 096519 - RESILIENT TILE FLOORING**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section includes resilient tile flooring (096519.A01) of the following types:
  - 1. Luxury vinyl floor tile.
- B. Related Sections:
  - 1. Section 012100 "Allowances" for allowances effecting work of this Section.
  - 2. Section 012200 "Unit Prices" for unit prices effecting work of this Section.
  - 3. Section 096513 "Resilient Base and Accessories" for related base and floor transitions.

#### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
  - 1. Floor patterns and transition strip locations.
  - 2. Layout, colors, widths, and dimensions of game lines and markers.
  - 3. Seam locations for sheet flooring.
- C. Samples for Verification: Samples: For each exposed product and for each color and texture specified in manufacturer's standard size, but not less than 6-by-9-inch sections.

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Qualification Data:
  - 1. For qualified flooring installer.
  - 2. For qualified flooring manufacturer.
- B. Preparation and Installation Guidelines: For each type of resilient flooring, including current subfloor preparation guidelines in addition to installation guidelines published by flooring manufacturer.
- C. Slab Moisture Testing Results: Refer to Part 3 of this Section.

#### **1.4 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For each type of floor tile to include in maintenance manuals.
- B. Warranty:
  - 1. Manufacturer material warranty.
  - 2. Installer installation warranty.

#### **1.5 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. Floor Tile: Furnish one un-opened box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

## 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
  - 1. ISO 9001 Certified.
  - 2. ISO 14001 Certified.
  - 3. At least ten years active experience in the manufacture and marketing of indoor resilient flooring.
  - 4. A provider of authorized installer training.
  - 5. Must be competent in techniques required by manufacturer for resilient flooring installation indicated.
- B. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
  - 1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required and shall have at least five years' experience.
- C. Fire Test Characteristics: As determined by testing identical products according to ASTM E 648, Class 1, by a qualified testing agency acceptable to authorities having jurisdiction.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storing.
- B. Store floor tile 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 or more than 90 deg F. Store floor tiles on flat surfaces.

## 1.8 FIELD CONDITIONS

- A. Maintain temperatures during installation within range recommended in writing by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive flooring 48 hours before installation, during installation, and 48 hours after installation unless longer period is recommended in writing by manufacturer.
  - 1. After post-installation period, maintain temperatures within range recommended in writing by manufacturer, but not less than 55 deg F or more than 95 deg F.
  - 2. Close spaces to traffic during flooring installation.
  - 3. Close spaces to traffic for 48 hours after flooring installation unless manufacturer recommends longer period in writing.
- B. Install floor tile after other finishing operations, including painting, have been completed.

## 1.9 WARRANTY

- A. Special Limited Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace resilient flooring that fails within specified warranty period.
  - 1. Material warranty direct from the product manufacture and not a separate or third party insurance provider.
  - 2. Failures include, but are not limited to, the following
    - a. Material manufacturing defects.
    - b. Surface wear and deterioration to the point of wear-through.
    - c. Failure due to substrate moisture exposure not exceeding 5 pounds moisture vapor emission rate when tested according to ASTM F 1869, and 80 percent relative humidity when tested according to ASTM F 2170.
  - 3. Warranty Period:
    - a. For materials: 2 years from date of Substantial Completion.
    - b. For surface wear: 15 years from date of Substantial Completion.
- B. Special Limited Warranty: Installer's standard form in which installer agrees to repair or replace sports flooring that fails due to poor workmanship or faulty installation within the specified warranty period.
  - 1. Warranty Period: Two years from date of Substantial Completion.

## PART 2 PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient tile flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
  - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

### 2.2 LUXURY VINYL FLOOR TILE (096519.A01 – **RF1**)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide "Moment" by Bentley Mills. Comparable products from other manufacturers will be considered, which match color and pattern selected to Architect's satisfaction and, are submitted to and accepted by Architect prior to bidding.
  - 1. Tile Standard: ASTM F 1700.
    - a. Class: Class III, printed film vinyl tile
    - b. Type: B embossed surface.
  - 2. Product Characteristics:
    - a. Thickness: 2.5 mm.
      - 1) Wear layer thickness 20 mil.
    - b. Size: 9 inches by 48 inches.
    - c. Edges: Square edged (SE).
  - 3. Performance Characteristics:
    - a. Static Load Limit: Passes, modified at 1,750 psi when tested according to ASTM F 970.
    - b. Commercial Traffic Class: Heavy

### 2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient sheet flooring manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by tile flooring and adhesive manufacturers for each type of tile flooring. Adhesive shall be suitable for substrate conditions involved and compatible with flooring.
  - 1. Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. LVT with Quick Stick pre-applied adhesive – 99% R.H., MVER 18, pH12.
- D. Topical Concrete Vapor Sealer: Liquid penetrating type or film-forming type, designed to seal concrete and inhibit moisture transmission through slab. Concrete vapor sealers shall be as recommended by resilient tile flooring contractor based upon successful previous installations and as acceptable to resilient tile flooring manufacturer. Refer to Section 012200 "Unit Prices".
- E. Metal Transition Strips: Provide pre-manufactured aluminum edging, 3/8 inch high by 2-1/2 inches wide in manufacturer's standard lengths and in longest lengths practical.
  - 1. Basis-of-Design Product: Gradus; "Model TT35/AFT15". Comparable products matching profile and characteristics of specified product will be considered.
  - 2. Fasteners: Provide post-installed expansion anchors with Type 304 stainless steel countersunk fasteners.

## 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 floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare 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 carpet tile manufacturer. Do not use solvents.
  3. Alkalinity and Adhesion Testing: Perform tests recommended by carpet tile 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 (Contractor's Option):
    - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours, unless a higher rate is accepted by flooring manufacturer in writing.
    - b. Perform relative humidity test using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 80 percent relative humidity level measurement, unless a higher rate is acceptable to flooring manufacturer.
- C. Concrete Vapor Sealer Application: Prepare surfaces to receive concrete vapor sealer and apply concrete vapor sealer in strict accordance with vapor sealer manufacturer's written instructions to suit slab moisture conditions encountered.
- D. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate according to manufacturer's written instructions.
1. Fill cracks 1/8 inch wide and wider, fill and level holes and depressions 1/4 wide or wider and grind level all protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.
- E. Do not install floor tiles until they are the same temperature as the space where they are to be installed.
- F. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

### 3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
1. Lay tiles square with room axis, unless specifically indicated otherwise.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
1. Lay luxury vinyl tiles with grain running in one direction.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.



- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

#### 3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
  - 1. Remove adhesive and other blemishes from exposed surfaces.
  - 2. Sweep and vacuum surfaces thoroughly.
  - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
  - 1. Do not move heavy and sharp objects directly over flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.
- D. Cover floor tile until Substantial Completion.

END OF SECTION 096519

This page intentionally left blank

## **SECTION 096566 - RESILIENT ATHLETIC FLOORING**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Sheet resilient athletic flooring (096566.A01 – RF2).
- B. Related Sections:
  - 1. Section 012100 "Allowances" for allowances effecting work of this Section.
  - 2. Section 012200 "Unit Prices" for unit prices effecting work of this Section.
  - 3. Section 096513 "Resilient Base and Accessories" for wall base and accessories installed with flooring.

#### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show installation details and locations of the following:
  - 1. Floor patterns and transition strip locations.
  - 2. Layout, colors, widths, and dimensions of game lines and markers.
  - 3. Locations of floor inserts for athletic equipment installed through flooring.
  - 4. Seam locations for sheet flooring.
- C. Samples for Initial Selection: For each type of resilient athletic flooring.
  - 1. Game-Line and Marker Paint: Include charts showing available colors and glosses.
- D. Samples for Verification: For each type, color, and pattern of flooring specified, 6-inch- square in size and of same thickness and material indicated for the Work.
  - 1. Seam Samples: For each vinyl sheet flooring color and pattern required; with seam running lengthwise and in center of 9 by 12 inch sample applied to a rigid backing and prepared by Installer for this Project.
  - 2. Vent cove base: Include color options matching color indicated on Interior Material Finish Legend.
- E. Manufacturer Certifications
  - 1. For ISO 9001 manufacture.
- F. Laboratory Test Results:
  - 1. Shock absorption (force reduction) test results certified by an independent testing laboratory certified to perform such testing.
    - a. ASTM test must be from certified North American laboratories.

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Qualification Data:
  - 1. For qualified resilient athletic flooring Installer.
  - 2. For qualified resilient athletic flooring Manufacturer.
- B. Preparation and Installation Guidelines: For each type of resilient athletic flooring, including current subfloor preparation guidelines in addition to installation guidelines published by flooring manufacturer.

#### **1.4 CLOSEOUT SUBMITTALS**

- A. Maintenance data to be included in the Operations and Maintenance Manuals.
- B. Warranty:
  - 1. Manufacturer material warranty.
  - 2. Installer installation warranty.

## 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
  - 1. ISO 9001 Certified for quality control.
  - 2. ISO 14001 Certified for environmental care.
  - 3. At least ten years active experience in the manufacture and marketing of indoor resilient athletic flooring.
  - 4. A provider of authorized installer training.
  - 5. Must be competent in techniques required by manufacturer for resilient athletic flooring installation indicated.
- B. Sheet Athletic Flooring Installer Qualifications: An experienced Installer who has completed resilient sheet vinyl athletic flooring installations using seaming methods indicated for this Project and similar in material, design, and extent to that indicated for this Project; who is acceptable to manufacturer; and whose work has resulted in installations with a record of successful in-service performance.
  - 1. Installer shall have at least five years experience in the installation of resilient athletic flooring.
  - 2. Installer shall employ workers for this Project who are competent in techniques required by manufacturer for resilient athletic flooring installation indicated.
- C. Fire Test Characteristics: As determined by testing identical products according to ASTM E 648, Class 1, by a qualified testing agency acceptable to authorities having jurisdiction.
- D. Athletic Performance Properties: Comply with ASTM F 2772 Performance Level C2 for force reduction and ball rebound.
- E. Mockups/Field Samples: Build mockups/field samples to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Build mockups/field samples for resilient athletic flooring including resilient base and accessories.
    - a. Size: Minimum 50 sq. ft. for each type, color, and pattern in locations directed by Architect.
  - 2. Approval of mockups/field samples does not constitute approval of deviations from the Contract Documents contained in mockups/field samples 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.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storing.
- B. Store materials to prevent deterioration as recommended by flooring manufacturer.

## 1.7 FIELD CONDITIONS

- A. Adhesively Applied Products:
  - 1. Maintain temperatures during installation within range recommended in writing by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive flooring 48 hours before installation, during installation, and 48 hours after installation unless longer period is recommended in writing by manufacturer.
  - 2. After post-installation period, maintain temperatures within range recommended in writing by manufacturer, but not less than 55 deg F or more than 95 deg F.
  - 3. Close spaces to traffic during flooring installation.
  - 4. Close spaces to traffic for 48 hours after flooring installation unless manufacturer recommends longer period in writing.
- B. Install flooring after other finishing operations, including painting, have been completed.

## 1.8 COORDINATION

- A. Coordinate layout and installation of flooring with floor inserts for gymnasium equipment.

## 1.9 WARRANTY

- A. Special Limited Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace sports flooring that fails within specified warranty period.
  - 1. Material warranty direct from the product manufacture and not a separate or third party insurance provider.
  - 2. Failures include, but are not limited to, the following
    - a. Material manufacturing defects.
    - b. Surface wear and deterioration to the point of wear-through.
    - c. Failure due to substrate moisture exposure not exceeding 5 pounds moisture vapor emission rate when tested according to ASTM F 1869, and 80 percent relative humidity when tested according to ASTM F 2170.
  - 3. Warranty Period:
    - a. For materials: 2 years from date of Substantial Completion.
    - b. For surface wear: 10 years from date of Substantial Completion.
- B. Special Limited Warranty: Installer's standard form in which installer agrees to repair or replace sports flooring that fails due to poor workmanship or faulty installation within the specified warranty period.
  - 1. Warranty Period: Two years from date of Substantial Completion.

## PART 2 PRODUCTS

### 2.1 RESILIENT ATHLETIC FLOORING (096566.A01 – RF2)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide; Gerflor Taraflex Sport M Plus DRY-TEX Sports Flooring installed with high-moisture tolerant full-spread adhesive or comparable product by one of the following, submitted to and accepted by Architect prior to bidding:
  - 1. "Omnisports" Tarkett company.
  - 2. Johnsonite; a Tarkett company.
  - 3. Robbins Sports Surfaces.
  - 4. Sport Court; Subsidiary of Connor Sport Court International.
- B. Description: Sheet vinyl flooring specifically designed for adhered athletic flooring applications.
- C. Athletic Sheet Flooring with Backing: ASTM F 1303.
  - 1. Overall Thickness: Not less than 0.28 inch (7 mm).
  - 2. Wear-Layer Thickness: Not less than 0.08 inch (2.1 mm).
  - 3. Backing: Very high density, two layer, dual-durometer, closed cell foam with reinforced fiberglass grid.
  - 4. Seaming Method: Heat welded.
  - 5. Traffic-Surface Texture: Wood visual shall have wood grain embossed texture for a genuine wood appearance.
  - 6. Applied Finish: Manufacturer's, factory-applied, permanent and UV-cured.
    - a. Basis-of-Design Product: Gerflor ProtecSol.
  - 7. Bacteriostatic and Fungicidal Treatment: Manufacturer's factory-applied permanent treatment.
    - a. Basis-of-Design Product: Gerflor Sanosol.
- D. Roll Size: Not less than 59 inches wide by longest length that is practical to minimize splicing during installation.
- E. Color and Pattern: Match color and pattern as indicated on Material Finish Schedule as acceptable to Architect.
- F. Performance Criteria:
  - 1. Shock Absorption/Force Reduction: ASTM F 2772; Pass/Class C2.
  - 2. Ball Bounce: ASTM F 2772; Pass, Greater than or equal to 90 percent.
  - 3. Sliding/Coefficient of Friction: DIN-18032; Pass.
  - 4. Surface effect/Coefficient of Friction: Between 80-110.
  - 5. Vertical Deformation: Max. 3.5mm
  - 6. Static Load Limit/Indentation Resistance: ASTM F 1303; Pass, Less than or equal to 0.005 inch of residual indentation as tested per ASTM F 970 at 175 p.s.i.
  - 7. Fire Performance: ASTM E 648; Greater than 0.45 W/cm2, Class 1.
  - 8. Chemical Product Resistance: ASTM D 543; excellent.

9. Surface Maintenance Requirements: No-wax surface requiring only cleaning and rinsing.
10. Antibacterial and Fungicidal Treatments: Similar to Gerflor/Taraflex Sports Flooring; "Sanosol".

## 2.2 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by flooring manufacturer.
- B. Adhesives: Water-resistant type recommended in writing by manufacturer for substrate and conditions indicated.
- C. Topical Concrete Vapor Sealer: Liquid type, 2-part cross-linked latex solution designed to seal concrete and inhibit moisture transmission through slab. Sealer shall be capable of reducing MVER up to 15 lbs. down to 3 lbs or less.
  1. Basis of Design Product: Subject to compliance with requirements, provide "Vaporseal HM Plus" as manufactured by Dependable Floor Products or comparable products from other manufacturers recommended by flooring manufacturer.

## 2.3 HIGH-MOISTURE TOLERANT ADHESIVE

- A. Basis-of-Design Product: Subject to compliance with requirements, provide; "R-701 2-part Urethane Adhesive" by Stauf USA. High-moisture tolerant full-spread adhesive, or comparable products with the following product characteristics submitted to and accepted by Architect prior to bidding:
  1. Manufacturer shall be certified under ISO 9001 All liquid materials, including primers are manufactured and tested under an ISO 9001 registered quality system.
- B. System:
  1. Primer: EHS265 applied between 6-8 mils. (not Required).
  2. Adhesive: R-701 spread using a notched trowel to apply proper amount of adhesive to hold the flooring in place.
  3. Modular Flooring Products as specified in this Section above.
- C. Materials:
  1. Primer: EHS265 is a 2-part epoxy resin for priming prior to applying urethane adhesive with the following properties:
    - a. Pull off Strength (ASTM D4541) >
    - b. Shore D Hardness (ASTM D2240)
    - c. Solid Content
    - d. VOC Content (ASTM D2369)
    - e. Permeability (ASTM E96)
    - f. Water Absorption (ASTM D570)
    - g. Viscosity (approximately) of Components 1 + 2:
  2. Adhesive: R-701 is a 2-part, low viscosity, 100% solid Urethane Adhesive with the following properties:
    - a. Pull off Strength (ASTM D4541) > 1500
    - b. Solid Content 100% by volume and weight
    - c. VOC Content (ASTM D2369) 0 Rule 1168
    - d. Compressive Strength (ASTM C579) 5,000 at 7 days
    - e. Viscosity (approximately) of Components 1 + 2: 2000cps
    - f. Shear Strength (ASTM D6004-21) Flooring Failure

## 2.4 ACCESSORIES

- A. Vent Cove Base: Provide vented cove base around perimeter of floor at all wall lines with molded exterior corners.
  1. Basis-of-Design Product: Subject to compliance with requirements, Johnsonite Inc.: "Resilient Vent Cove Wall Base".
  2. Product Standard: ASTM F 1861, Type TS (thermoset vulcanized rubber).
    - a. Group: I (solid, homogeneous).
  3. Product Characteristics:
    - a. Thickness: 5/16 inch.

- b. Height: As indicated on drawings.
  - c. Lengths: 4 feet per manufacturer's standard length.
  - d. Outside Corners: Factory fabricated.
  - e. Inside Corners: Job formed.
  - f. Vents: 15 vents per 4-foot length.
  - g. Warranty: 5 years.
- 4. Colors: As indicated by manufacturer's designations on Material Finish Legend. Provide manufacturer's recommended adhesive.
- B. Expansion Cover Plate: Provide aluminum, door expansion void cover plate. Install per manufacturer's recommendation at all door openings. Plate shall be 1/8 inch thick in width indicated.
  - 1. Manufacturers and Products:
    - a. National Guard Products; Model #818.
    - b. Pemko; Model 18/1A.
    - c. Reese; Model BAP18.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances, 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.

### 3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of flooring.
- B. Concrete Substrates: Prepare 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 carpet tile manufacturer. Do not use solvents.
  - 3. Alkalinity and Adhesion Testing: Perform tests recommended by carpet tile 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 of Concrete Slabs:
    - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours, unless a higher rate is accepted by flooring manufacturer in writing.
      - 1) Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than two tests in each installation area and with test areas evenly spaced in installation areas.
    - b. Perform relative humidity test using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 80 percent relative humidity level measurement, unless a higher rate is acceptable to flooring manufacturer.
- C. Concrete Vapor Sealer Application: Prepare surfaces to receive concrete vapor sealer and apply concrete vapor sealer in strict accordance with vapor sealer manufacturer's written instructions to suit slab moisture conditions encountered.
- D. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by manufacturer. Do not use solvents.
- E. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate according to manufacturer's written instructions.

1. Fill cracks 1/8 inch wide and wider, fill and level holes and depressions 1/4 wide or wider and grind level all protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.
- F. Move flooring and installation materials into spaces where they will be installed at least 48 hours in advance of installation unless manufacturer recommends a longer period in writing.
  1. Do not install flooring until they are same temperature as space where they are to be installed.
- G. Sweep and vacuum clean substrates to be covered by flooring immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust.
- H. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.3 FLOORING INSTALLATION, GENERAL

- A. Comply with manufacturer's written installation instructions.
- B. Scribe, cut, and fit flooring to butt neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.
- C. Extend flooring into toe spaces, door reveals, closets, and similar openings unless otherwise indicated.
- D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating subfloor markings on flooring. Use non-permanent, non-staining marking device.

### 3.4 SHEET FLOORING INSTALLATION

- A. General: Install in configurations indicated. Prepare surface and install flooring in strict accordance with the flooring manufacturer's written recommendations.
- B. Unroll sheet flooring and allow it to stabilize before cutting and fitting.
- C. Lay out sheet flooring as follows:
  1. Maintain uniformity of flooring direction.
  2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
  3. Match edges of flooring for color shading at seams.
  4. Locate seams per approved Shop Drawings.
- D. Adhered Flooring: Adhere products to substrates using a full spread of adhesive applied to substrate to comply with adhesive and flooring manufacturers' written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.
  1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- E. Sheet Flooring Seams: Prepare and finish seams to produce surfaces flush with adjoining flooring surfaces.
  1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and use welding bead to permanently fuse sections into a seamless flooring.

### 3.5 FIELD-APPLIED FINISHES

- A. Apply finish after game-line and marker paint is fully cured.
- B. Apply finish according to manufacturer's written instructions to produce a sealed surface that is ready for use.
- C. Do not cover flooring after finishing until finish reaches full cure.



### 3.6 CLEANING AND PROTECTING

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing flooring installation:
  - 1. Remove adhesive and other blemishes from flooring surfaces.
  - 2. Sweep and vacuum flooring thoroughly.
  - 3. Damp-mop flooring to remove marks and soil after time period recommended in writing by manufacturer.
- C. Protect flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
  - 1. Do not move heavy and sharp objects directly over flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

### 3.7 INSTALLATION OF ACCESSORIES

- A. Vent-Cove Base: Install base around perimeter of floor at all wall lines in accordance with Manufacturer's recommendations for adhesive installation and attachment methods. Miter all inside corners.
- B. Cover-plate Assembly: Install at all doors entering gymnasium and stage in strict accordance with manufacturer's recommendations and approved shop drawings. Scribe to fit door frames and recessions.

END OF SECTION 096566

This page intentionally left blank

## **SECTION 096723 - RESINOUS FLOORING**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section includes seamless resinous flooring systems (096723.A01) with integral base (096723.A02).
- B. Related Sections:
  - 1. Section 012200 "Unit Prices" for waterproofing membrane.
  - 2. Section 096513 "Resilient Base and Accessories".

#### **1.2 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:
    - a. Review delivery, storage, and handling procedures.
    - b. Review ambient conditions and ventilation procedures.
    - c. Review subfloor preparation procedures.
    - d. Review layout and patterns.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required; in addition to the following:
  - 1. List each material and cross-reference the specific coating, finish system and application. Identify each material by manufacturer's catalog number and general classification.
  - 2. Laboratory Test Reports: For resinous flooring systems, documentation indicating that products comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers".
- B. Samples for Verification: Prior to beginning work, submit samples for each resinous flooring system color, texture and sheen required and as follows:
  - 1. Samples shall be 6 inches square, applied to a rigid backing by Installer for this Project.
  - 2. Resubmit samples as requested until required sheen, color and texture is acceptable to Architect.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Installer Certificates: Submit certificates signed by manufacturer certifying that installers comply with specified requirements, in addition to the following:
  - 1. Submit substantiating evidence of experience installing the specific brand of products proposed in similar areas, in addition to meeting Installer Qualification criteria.

#### **1.5 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For resinous flooring to include in maintenance manuals.

#### **1.6 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. 10-pounds of additional product.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an Installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated. Installer shall be/have been trained by flooring system manufacturer with experience in application and installation of systems similar in complexity to those required for this project, in addition to the following:
  - 1. Installer shall have a minimum of two (2) years continuous experience under the current company name.
  - 2. Installer shall submit a reference list of at least three (3) projects, similar in size and applied system(s), completed in the states of Missouri. Include contact information for General Contractor or Construction Manager and Owner. List types and names of systems installed, each material/component of system(s) installed, quantity installed and dates completed.
- B. Mockups/Field Samples: Build mockups/field samples to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Build mockups/field samples in conjunction with the wall tile mock-up installation. Mockup/field sample shall extend to floor to demonstrate transition from wall to floor.
  - 2. Approved mockups/field samples may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components. Include handling instructions and precautions.
- B. Store materials not in actual use in tightly covered containers at a minimum ambient temperature of 45 deg F in a well-ventilated area. Maintain containers in clean condition, free from foreign material and residue.
  - 1. Protect liquid components from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary precautionary measures to ensure workmen and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and application of floor systems.

## 1.9 FIELD CONDITIONS

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.
  - 1. Do not commence work until the building can be maintained at a temperature range between 60 deg F and 90 deg F for 48 hours before, during and 48 hours after application. Broom clean areas (reasonably dust free) and have adequate controlled ventilation.
  - 2. Maintain ventilation in each area indicated to receive resinous flooring until completion of the resinous flooring work in that area.
- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
- C. Close spaces to traffic during resinous flooring application and for 24 hours after application unless manufacturer recommends a longer period.
- D. Surfaces to receive resinous flooring must be acceptable and in accordance with flooring system manufacturer's recommendations.
  - 1. Provide clean, dry, and neutral substrate for resinous flooring application.
  - 2. Notify Owner's Representative in writing of unsuitable surfaces and conditions. Commencement of work implies acceptance of surfaces and working conditions.

## 1.10 PROTECTION

- A. Protect adjacent surfaces from damage resulting from work of this trade. If necessary, mask and/or cover adjacent surfaces, fixtures, cabinetry, equipment, etc. by suitable means.
- B. Post "NO SMOKING" signs while work is in progress and during curing.

## 1.11 SPECIAL WARRANTY

## PART 2 PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Low-Emitting Materials: Flooring system shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Department of Health Services) "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Flammability: Self-extinguishing according to ASTM D 635.
- C. Slip Resistance: Resinous flooring surfaces shall have the following minimum performance requirements as indicated below.
  - 1. Static Dry Coefficient of Friction: 0.6 minimum per ASTM D2047.
  - 2. Dynamic Wet Coefficient of Friction: 0.45 minimum per ANSI A326.3 or ANSI B101.3.

### 2.2 MANUFACTURERS

- A. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, body coats, and topcoats, from single source from single manufacturer to ensure material compatibility, chemical and mechanical bond; quality of materials, color and pattern consistency. Obtain secondary materials, including patching and fill material, color chips/flakes and granules, joint sealant, and repair materials, of type and from manufacturer recommended in writing by manufacturer of primary materials.

### 2.3 RESINOUS FLOORING (096723.A01 – FT1)

- A. Basis-of-Design Product: Subject to compliance with specified requirements, provide DESCO Coatings, Inc; "Cremona TG" with aliphatic urethane topcoat, resinous flooring system or one of the resinous flooring systems listed below.
  - 1. Dur-A-Flex; "DUR-A-Quartz Q11" with aliphatic urethane topcoat.
  - 2. Stonhard; "Stonetec ERF" with aliphatic urethane topcoat.
  - 3. Sherwin-Williams Resufloor Quartz TQ with aliphatic urethane topcoat.
  - 4. Tnemec; Series 223 "DECO-Trowel" with aliphatic urethane topcoat.
  - 5. Comparable products from manufacturers listed below and other manufacturers which meet or exceed specified requirements will also be considered when submitted to and accepted by Architect as a substitution prior to bidding only.
- B. Resinous Flooring System: System shall be a trowel-applied, abrasion-, UV-, impact-, and chemical-resistant, aggregate-filled, and resin-based monolithic floor surfacing designed to produce a seamless floor and integral cove base. System shall be capable of being applied over an existing epoxy resinous floor.
- C. System Characteristics:
  - 1. Color and Patterns: As noted on Material Finish Schedule.
  - 2. Wearing Surface: Orange-peel texture to match approved sample.
    - a. Slip resistance shall not be less than performance requirements indicated in this Section.
  - 3. Overall System Thickness: Not less than 3/16 inch.

- D. Primer: Provide manufacturer's recommended primer to suit substrate and resinous flooring system indicated.
  - 1. Formulation Description: 100 percent solids.
- E. Body Coats:
  - 1. Resin: Epoxy.
  - 2. Formulation Description: 100 percent solids.
  - 3. Type: Clear or colored to suit design mix selected.
  - 4. Application Method: Self-leveling slurry with broadcast aggregates.
  - 5. Aggregates: Colored quartz (ceramic-coated silica).
    - a. Quartz aggregate shall be Grade 11.
- F. Topcoats: Sealing or finish coats.
  - 1. Resin: Aliphatic Urethane.
  - 2. Formulation Description: High solids.
  - 3. Type: Clear.
  - 4. Number of Coats: As required to achieve overall system thickness specified and texture selected.
  - 5. Finish Texture and Sheen: Match sample approved by Owner's Representative.
- G. Integral Cove Base: Provide integral coved base to 8 inches with 1 inch radiused cove and bullnosed top edge termination. Provide keyed joint where resinous flooring terminates with other materials.
- H. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:
  - 1. Compressive Strength (Binder): 14,000 psi minimum according to ASTM D 695.
  - 2. Compressive Strength (System): 10,000 psi minimum according to ASTM C 579.
  - 3. Tensile Strength: 2,250 psi minimum according to ASTM C 307.
  - 4. Bond Strength: 400 psi minimum according to ASTM D 4541.
  - 5. Water Absorption: 0.04 percent maximum according to ASTM D 570.
  - 6. Impact Resistance: No chipping, cracking, or delamination and not more than 1/16-inch permanent indentation according to MIL-D-3134J.
  - 7. Resistance to Elevated Temperature: No slip or flow of more than 1/16 inch according to MIL-D-3134J.
  - 8. Abrasion Resistance: 80 mg maximum weight loss according to ASTM D 4060.
  - 9. Hardness: 75-80 Shore D according to ASTM D 2240.
  - 10. Flame Spread/NFPA 101: Class A according to ASTM E 84.
- I. System Chemical Resistance: Test specimens of cured resinous flooring system are unaffected when tested according to ASTM D 1308 for 50 percent immersion in the following reagents for no fewer than seven days:
  - 1. Bleach (3%).
  - 2. Coffee.
  - 3. Hydro peroxide (3%).
  - 4. Nitric acid (10%).
  - 5. Phosphoric acid (20%).
  - 6. Sodium hydrate (40%).
  - 7. Urine.

## 2.4 ACCESSORIES

- A. Reinforcing Membrane: Flexible resin formulation that is recommended by resinous flooring manufacturer for substrate and resinous flooring system indicated and that inhibits substrate cracks from reflecting through resinous flooring.
  - 1. Formulation Description: Manufacturer's standard high solids.
    - a. Provide fiberglass scrim embedded in reinforcing membrane.
- B. Metal Transition Strips: Refer to Drawings.
  - 1. Basis-of-Design Product: Provide transition strips as indicated on Drawings, Sheet A681.
  - 2. Fasteners: Provide post-installed expansion anchors with Type 304 stainless steel countersunk fasteners.
    - a. Provide all fasteners and accessories necessary for secure and proper installation.
- C. At top of resinous wall base provide the following product. Colors shall match existing at project site as determined by Architect. Height of trim shall match thickness of resinous flooring system.
  - 1. Basis of Design Product: "Jolly" by Schluter.

- D. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.
- E. Joint Sealant: Type recommended or produced by manufacturer of resinous flooring system for type of service and joint condition indicated.
- F. Waterproofing Membrane: When required by manufacturer for a successful installation over project site conditions, provide and install a fluid applied moisture barrier membrane, to prevent excessive moisture/humidity conditions, allowing a fully warranted floor installation.
  - 1. Vapor barrier to allow 100% relative humidity at the floor surface, while maintaining the manufacturer's full warranty.
  - 2. Refer to Section 012200 "Unit Prices".

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Contractor shall examine subfloor surfaces to verify all substrates and conditions are satisfactory. A satisfactory subfloor surface is defined as one that is smooth and free from cracks, holes, ridges, curing compounds, and other adhesives and coatings that may inhibit bonding capability of resinous flooring and primer, as well as other defects that may impair performance and appearance.

### 3.2 PREPARATION

- A. Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry substrate for resinous flooring application.
  - 1. Areas where flooring is existing, must be cleaned to remove all floor material, adhesives, grease or any residue that may interfere with interfacial adhesion between substrate and new resinous flooring system.
  - 2. Prepare concrete substrates by shot blasting or grinding to achieve surface profile recommended by resinous flooring manufacturer.
- B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, adhesives, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
  - 1. Roughen concrete substrates as follows:
    - a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
    - b. Comply with ASTM C 811 requirements unless manufacturer's written instructions are more stringent.
  - 2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.
  - 3. Moisture testing is not required. However, Contractors at their own expense may, as they deem necessary, verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
    - a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with application of resinous flooring only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. of slab area in 24 hours.
    - b. Relative Humidity Test: Use in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 80 percent relative humidity level measurement.
  - 4. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
- C. Patching and Filling: Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
  - 1. Control Joint Treatment: Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.
- D. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

- E. Metal Transition Strips: Install at locations indicated and between resinous flooring and concrete. Transition strip may be used as a screed. Thicken resinous flooring application as necessary so flooring is flush with top of transition strip. Installation shall be in strict accordance with edging manufacturer's written recommendations.
- F. Cut Transition Edge:
  - 1. Saw cut 1/2 inch to 1 inch deep; curtail concrete back 3 to 4 inches.
  - 2. Install resinous flooring up to face of saw cut edge.
- G. Smooth Transition Edge at VCT:
  - 1. Install resinous flooring up to edge of VCT, protecting existing VCT from damage during resinous flooring installation.
  - 2. If required by manufacturer to accommodate thickness of resinous flooring system, saw cut existing concrete down to a depth required to install resinous flooring level with existing VCT.

### 3.3 APPLICATION

- A. Proceed with resinous flooring work after subfloor surfaces are satisfactory. Commencement of resinous flooring work is construed as Installer's acceptance of substrate surfaces within a particular area.
  - 1. Coordinate work within this section with adjacent finish work to achieve full coverage of each finish as required by each section.
- B. Apply components of resinous flooring system according to manufacturer's latest written instructions, employing technically-trained, approved mechanics, to produce a uniform, monolithic wearing surface of thickness indicated.
  - 1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
  - 2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
  - 3. Expansion and Isolation Joint Treatment: At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.
    - a. Do not fill moving isolation joints or expansion joints.
    - b. At movement joints, provide membrane isolation strips and reinforcing tape as recommended by resinous flooring manufacturer.
- C. Primer: Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- D. Reinforcing Membrane: Apply reinforcing membrane to substrate cracks.
  - 1. Fill non-moving control joints with approved elastomeric sealant or full-depth semi-rigid two-component epoxy joint filler, designed specifically for this purpose (use full-depth semi-rigid joint filler when reinforcement of the joint edge is desirable), or two-component epoxy and filler (epoxy to be same material as flooring).
- E. Troweled or Screeded Body Coats: Apply troweled or screeded body coats in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When body coats are cured, remove trowel marks and roughness using method recommended by manufacturer.
- F. Grout Coat: Apply grout coat, of type recommended by resinous flooring manufacturer, to fill voids in surface of final body coat.
- G. Topcoats: Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer and to produce wearing surface indicated.
- H. Cure resinous flooring in compliance with flooring manufacturer's directions to prevent contamination during all stages of application.
- I. Finish work shall match approved samples; be uniform in thickness, sheen, color and texture; and be free of defects detrimental to appearance and performance.
- J. Install metal transition strips where resinous flooring abuts other flooring materials. Securely anchor in place with mechanical fasteners as recommended by transition strip manufacturer.



### 3.4 FIELD QUALITY CONTROL

- A. Material Sampling: Owner's Representative may, at any time and any number of times during resinous flooring application, require material samples for testing for compliance with requirements.
  - 1. Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.
  - 2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's product data.
  - 3. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.
- B. Core Sampling: At the direction of Owner's Representative and at locations designated by Owner's Representative, take one core sample per 1000 sq. ft. of resinous flooring, or portion of, to verify thickness. For each sample that fails to comply with requirements, take two additional samples. Repair damage caused by coring. Correct deficiencies in installed flooring as indicated by testing.
- C. Touch-up or repair damaged coatings. Touch-up shall not be visibly different. Recoat entire surface if touch-up results are visible, either in sheen, texture or color.

### 3.5 CLEANING AND PROTECTION

- A. Clean resinous flooring prior to Substantial Completion. Use materials and procedures recommended by resinous flooring manufacturer.
- B. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.
  - 1. Remove any temporary covering prior to cleaning and final inspection.

END OF SECTION 096723

This page intentionally left blank

## **SECTION 096816 - SHEET CARPETING**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes the following types of sheet carpeting (096816.A01):
  - 1. Tufted textured loop carpet.
- B. Related Requirements:
  - 1. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet.

#### **1.2 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review methods and procedures related to carpet installation including, but not limited to, the following:
    - a. Review delivery, storage, and handling procedures.
    - b. Review ambient conditions and ventilation procedures.
    - c. Review subfloor preparation procedures.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For the following, including installation recommendations for each type of substrate:
  - 1. Carpet: For each type indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
- B. Shop Drawings: Show the following:
  - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
  - 2. Carpet type, color, and dye lot.
  - 3. Locations where dye lot changes occur.
  - 4. Seam locations, types, and methods.
  - 5. Types of substrate to receive carpeting.
  - 6. Pattern type, repeat size, location, direction, and starting point.
  - 7. Pile direction.
  - 8. Type, color, and location of insets and borders.
  - 9. Type, color, and location of edge, transition, and other accessory strips.
  - 10. Transition details to other flooring materials.
- C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
  - 1. Carpet: 12-inch- square Sample.
  - 2. Carpet Seam: 6-inch Sample.
  - 3. Edge Trim: 12 inch long sample.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For qualified Installer.
- B. Sample Warranties: For special warranties.

## 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet to include in maintenance manuals. Include the following:
  - 1. Methods for maintaining carpet, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
  - 2. Precautions for cleaning materials and methods that could be detrimental to carpet.

## 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Carpet: Full-width rolls equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced Installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level or higher.
- B. Fire-Test-Response Ratings: Where indicated, provide carpet identical to those of assemblies tested for fire response per NFPA 253 by a qualified testing agency.
- C. Mockups/Field Samples: Build mockups/field samples to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
  - 1. Build mockups/field samples at locations and in sizes shown on Drawings, including accessories.
    - a. Size: Minimum 60 sq. ft. for each type, color, and pattern in locations directed by Architect.
    - b. At stairs, include example of end wraps.
  - 2. Approval of mockups/field samples does not constitute approval of deviations from the Contract Documents contained in mockups/field samples unless Architect specifically approves such deviations in writing.
  - 3. Subject to compliance with requirements, approved mockups/field samples may become part of the completed Work if undisturbed at time of Substantial Completion.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104.

## 1.9 FIELD CONDITIONS

- A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.
- C. Do not install carpet over concrete slabs until slabs have cured, are sufficiently dry to bond with adhesive, and have pH range recommended by carpet manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet, install carpet before installing these items.

## 1.10 WARRANTY

- A. Special Warranty for Carpet: Manufacturer agrees to repair or replace components of carpet installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, loss of tuft bind strength, and delamination.
3. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 PRODUCTS

### 2.1 CARPET (096816.A01 - "C1")

- A. Subject to compliance with requirements, provide the following:
  1. Manufacturer and Product: Provide Bentley Mills; "Himitsu Ni" Style No. 4HM200620R.
    - a. Comparable products from other manufacturers, meeting specified requirements, will be considered when submitted to and accepted by Architect prior to bidding.
- B. Carpet Characteristics:
  1. Color and Pattern/Style: Refer to Material Finish Legend.
  2. Construction: Tufted textured loop.
  3. Roll Width: 12 feet.
  4. Machine Gauge: 1/12 inch.
  5. Stitches: 9.8 per inch.
  6. Pile Density: 7,020 oz/yd<sup>3</sup>.
  7. Total Weight: 78 oz/yd<sup>2</sup>.
  8. Total Thickness: 0.245 inch.
  9. Fiber System: Bentley Premium, Type 6,6 nylon.
  10. Dye Method: Solution dyed.
  11. Backing: Match Bentley Mills; High Performance PC backing.
  12. Flooring Radiant Panel: Class 1.
  13. Smoke Chamber Test: Less than 450 per ASTM E 662.
  14. Static Control: Under 3.5 kV per AATCC-134.
  15. Soil/Stain Protection: Manufacturer's standard treatment.

### 2.2 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, non-staining, pressure-sensitive type. Select adhesives suitable for substrate conditions and compatible with each type of carpeting and backing. Adhesives shall comply with flammability requirements for installed carpeting and be recommended by carpet manufacturer.
- C. Welded Seaming: Install using carpet manufacturer's recommended welded seam instructions for an aesthetically seamless installation. Refer to CRI 104, Section 12.3.1 "Hot Melt Seaming" for additional requirements.
- D. Resilient Edge/Transition Strips (096816.A02): Refer to Section 096513.
- E. Topical Concrete Vapor Sealer: Liquid penetrating type or film-forming type, designed to seal concrete and inhibit moisture transmission through slab. Concrete vapor sealers shall be as recommended by sheet carpeting Contractor based upon successful previous installations and as acceptable to sheet carpeting manufacturer.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet performance. Examine carpet for type, color, pattern, and potential defects.
- B. For wood subfloors, verify the following:

1. Underlayment over subfloor complies with requirements specified in Section 061000 "Rough Carpentry."
  2. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. General: Comply with CRI 104, Section 7.3, "Site Conditions; Floor Preparation," and with carpet manufacturer's written installation instructions for preparing substrates.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch, unless more stringent requirements are required by manufacturer's written instructions.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet manufacturer.
- D. Priming: Prime floor to indicated to receive sheet carpeting in accordance with sheet carpeting manufacturer's instructions. All patched areas shall be fully primed. Porous, gritty, chalky and dusty surfaces shall be primed.
- E. Concrete Substrates: Prepare 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 carpet tile manufacturer. Do not use solvents.
  3. Alkalinity and Adhesion Testing: Perform tests recommended by carpet tile 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.
    - a. Sheet carpet Installer, in conjunction with waterproofing (capillary break) admixture manufacturer's representative, shall conduct adhesion testing.
  4. Contractor, as he deems necessary, may conduct moisture testing of slabs:
    - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours, unless a higher rate is accepted by flooring manufacturer in writing.
      - 1) Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than two tests in each installation area and with test areas evenly spaced in installation areas.
    - b. Perform relative humidity test using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 80 percent relative humidity level measurement, unless a higher rate is acceptable to flooring manufacturer.
- F. Concrete Vapor Sealer Application: When concrete vapor sealer is required, prepare surfaces to receive concrete vapor sealer and apply concrete vapor sealer in strict accordance with vapor sealer manufacturer's written instructions to suit slab moisture conditions encountered.
- G. Broom and vacuum clean substrates to be covered immediately before installing carpet.

### 3.3 INSTALLATION

- A. Comply with CRI 104 and carpet manufacturer's written installation instructions for the following:
1. Direct-Glue-Down Installation: Comply with CRI 104, Section 9, "Direct Glue-Down Installation."
  2. Stair Installation: Comply with CRI 104, Section 13, "Carpet on Stairs" for glue-down installation.
- B. Comply with carpet manufacturer's written recommendations and Shop Drawings for seam locations and direction of carpet; maintain uniformity of carpet direction and lay of pile. At doorways, center seams under the door in closed position.
- C. Do not bridge building expansion joints with carpet.

- D. Cut and fit carpet to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet manufacturer.
- E. Extend carpet into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, non-staining marking device.
- G. Install pattern parallel to walls and borders to comply with CRI 104, Section 15, "Patterned Carpet Installations" and with carpet manufacturer's written recommendations.

#### 3.4 CLEANING AND PROTECTING

- A. Perform the following operations immediately after installing carpet:
  - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet manufacturer.
  - 2. Remove yarns that protrude from carpet surface.
  - 3. Vacuum carpet using commercial machine with face-beater element.
- B. Protect installed carpet to comply with CRI 104, Section 16, "Protecting Indoor Installations."
- C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet manufacturer and carpet adhesive manufacturer.

END OF SECTION 096816

This page intentionally left blank



## SECTION 099123 - INTERIOR PAINTING

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following interior substrates:
  - 1. Concrete.
  - 2. Concrete masonry units (CMUs).
  - 3. Steel and iron.
  - 4. Galvanized metal.
  - 5. Aluminum (not anodized or otherwise coated).
  - 6. Wood.
  - 7. Gypsum board.
  - 8. Plaster.
  - 9. Miscellaneous mechanical, electrical, plumbing, fire suppression, communication and technology work as delineated in this Section.
- B. Related Requirements:
  - 1. Section 012100 "Allowances" for those allowances affecting work of this Section.
  - 2. Section 012200 "Unit Prices" for unit prices affecting work of this Section.
  - 3. Section 012300 "Alternates" for those alternates related to work of this Section.
  - 4. Section 051200 "Structural Steel Framing" for shop priming structural steel.

#### 1.2 DEFINITIONS

- A. Gloss Level 1 "Matte": Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 2 "Flat": Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 3 "Eggshell": 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 4 "Satin-like": 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. Gloss Level 5 "Semi-gloss": 35 to 70 units at 60 degrees, according to ASTM D 523.
- F. Gloss Level 6 "Gloss": 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. Gloss Level 7 "High Gloss": More than 85 units at 60 degrees, according to ASTM D 523.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
  - 1. Indicate VOC content.
- B. Samples for Initial Selection: Where colors are not specifically indicated, submit for each type of topcoat product.
- C. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
  - 1. Submit Samples on rigid backing, 8 inches square.
  - 2. Label each coat of each Sample.
- D. Product List: For each product indicated, include the following:
  - 1. Cross-reference to paint system and locations of application areas.
  - 2. Use same designations indicated on Drawings and in schedules.

3. Include color designations.
4. VOC content.

#### 1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Paint: 1 gallon of each material and color applied.

#### 1.5 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
    - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
    - b. Other Items: Architect will designate items or areas required.
  2. Final approval of color selections will be based on mockups.
    - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
  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. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
  1. Maintain containers in clean condition, free of foreign materials and residue.
  2. Remove rags and waste from storage areas daily.

#### 1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers - Basis of Design Products: Subject to compliance with requirements, provide products by The Sherwin-Williams Company, or comparable products from other manufacturers submitted to and accepted by Architect and Owner prior to bidding.

#### 2.2 PAINT, GENERAL

- A. Material Compatibility:
  1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
- B. VOC Content: For field applications, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits for paints and paint colorants:
    1. Paints and Coatings: Less than 50 g/L.
  - C. Low-Emitting Materials: For field applications that are inside the weatherproofing system, 90 percent of paints and coatings 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."
  - D. Colors: Where not indicated on Drawings, as selected by Architect from manufacturer's full range.
    1. Twenty percent of surface area will be painted with deep tones.
  - E. Material Finish Schedule designations: As indicated on Material Finish Legend.
    1. Provide "flat" sheen for ceilings, unless otherwise specified.
  - F. Provide "eggshell" sheen for walls, unless otherwise specified.
  - G. Paint Systems: Refer to schedule at end of this Section.

### 2.3 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
  1. Owner may engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
  2. Testing agency will perform tests for compliance with product requirements.
  3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  1. Concrete: 12 percent.
  2. Masonry (Clay and CMUs): 12 percent.
  3. Wood: 15 percent.
  4. Gypsum Board: 12 percent.
  5. Plaster: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Plaster Substrates: Verify that plaster is fully cured.
- E. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- F. Proceed with coating application only after unsatisfactory conditions have been corrected.
  1. Application of coating indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, marker boards and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
  - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Concrete Substrates: Remove all surface contamination such as release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
  - 1. Wash previously painted surfaces with an abrasive cleanser and dull in one operation, or wash thoroughly and dull by sanding. Spot prime any bare areas with an appropriate primer.
  - 2. Verify that chemical removal agents (if used) have been neutralized prior to installation of paint products.
- E. Masonry Substrates: Remove all surface contamination such as oil, grease, loose paint, mill scale, dirt, foreign matter, rust, mold, mildew, mortar, efflorescence and sealers. Wash surfaces with an abrasive cleanser and dull in one operation, or wash thoroughly and dull by sanding. Spot prime any bare areas with an appropriate primer.
  - 1. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- F. Existing Brick Substrates: Remove all surface contamination such as oil, grease, loose paint, mill scale, dirt, foreign matter, rust, mold, mildew, efflorescence and sealers. Wash surfaces thoroughly. Where brick has been previously painted or sealed, wash surfaces with an abrasive cleanser and dull in one operation, or wash thoroughly and dull by sanding. Spot prime any bare areas of previously painted brick with specified primer.
- G. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer, but not less than the following:
  - 1. SSPC-SP 3.
- H. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- I. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- J. Aluminum Substrates: Remove loose surface oxidation.
- K. Wood Substrates:
  - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
  - 2. Sand surfaces that will be exposed to view, and dust off.
  - 3. Prime edges, ends, faces, undersides, and backsides of wood.
  - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- L. Existing Wood Door Substrates:
  - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
  - 2. Repair any major aesthetic and structural imperfections with epoxy hardening compound.
  - 3. Sand surfaces that will be exposed to view, and dust off.
  - 4. Prime edges, ends, faces, undersides, and backsides of wood.
  - 5. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler.

- M. Existing Substrates: Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
  - 1. Prepare substrates in accordance with paint manufacturer's recommendations to ensure adhesion.

### 3.3 APPLICATION

- A. Apply paints according to paint manufacturer's written instructions and to recommendations.
  - 1. Use applicators and techniques suited for paint and substrate indicated.
  - 2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
  - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
  - 5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
  - 6. Paint exposed air diffusers and grilles same color as adjacent wall or ceiling finish as directed by Architect.
  - 7. Mask off surfaces of doors prior to painting vision lite frames. Clean any excess paint from door surface to so that there is no evidence of excess paint remaining on door face and glass.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
  - 1. Paint the following work where exposed in occupied spaces:
    - a. Equipment, including panelboards.
    - b. Uninsulated metal piping.
    - c. Uninsulated plastic piping.
    - d. Pipe hangers and supports.
    - e. Metal conduit.
    - f. Plastic conduit.
    - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
    - h. Other items as directed by Architect.
  - 2. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.
- F. Marking and Identification: Fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other walls required to have protected openings and penetrations shall be permanently identified with stenciling. Such identification shall:
  - 1. Be located in accessible concealed floor, floor/ceiling or attic spaces;
  - 2. Be located within 15 feet of the end of each wall and at intervals not exceeding 30 feet measured horizontally along the wall or partition; and
  - 3. Shall include lettering not less than 3 inches in height with a minimum 3/8-inch wide stroke in a contrasting color incorporating the following wording on the first line: "FIRE AND/OR SMOKE BARRIER – PROTECT ALL OPENINGS".

### 3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.

1. Contractor shall touch up and restore painted surfaces damaged by testing.
2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

### 3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

### 3.6 INTERIOR PAINTING SCHEDULE

- A. CMU Substrates – Latex System:
  1. The Sherwin-Williams Company.
    - 1) 1 touchup coat ProMar 200 Zero VOC Interior Latex Primer (spot prime bare areas).
    - 2) 2 coats ProMar 200 Zero VOC Latex, Eggshell
- B. CMU Substrates, Wall Surfaces - Latex System.
  1. The Sherwin-Williams Company. (For gyms, Corridors, cafeterias, and toilets).
    - a. Block Filler: Pro Industrial Heavy Duty Block Filler, B42W150.
      - 1) at 16.0 mils wet, 8.0 mils dry.
    - b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
    - c. Topcoat: Pro Industrial Pre-Catalyzed Water Based Epoxy, K45-1151 Series, eggshell.
      - 1) at 4.0 mils wet, 1.5 mils dry, per coat.
- C. Steel Substrates – Non-primed:
  1. The Sherwin-Williams Company.
    - a. 1 coat of Pro Industrial Pro-Cryl Universal WB Acrylic Primer.
    - b. 2 coats Pro Industrial WB Alkyd Urethane, semigloss.
- D. Steel Substrates – Pre-primed:
  1. The Sherwin-Williams Company.
    - a. 1 coat of Pro Industrial Pro-Cryl Universal WB Acrylic Primer.
    - b. 2 coats Pro-Industrial Acrylic.
- E. Steel Hollow Metal Doors and Frames (including doors, frames, metal glass stops, vision lite frames, astragals and metal louvers):
  1. The Sherwin-Williams Company.
    - a. Prime Coat: Rust-inhibitive: Pro Industrial Pro-Cryl Universal Primer, B66-310 Series.
      - 1) at 5.0 to 10 mils wet, 2.0 to 4.0 mils dry.
    - b. Intermediate Coat: Matching topcoat.
    - c. Topcoat: Industrial Enamel, Gloss
      - 1) at 4.0 mils wet, 1.5 mils dry, per coat.
- F. Steel Substrates (exposed metal decking, bar joists and exposed overhead structure) – Dryfall.
  - a. 2 coats Speedhide Supertech Acrylic Dryfall.
  2. The Sherwin-Williams Company.
    - a. Top Coat: Pro Industrial Waterborne Acrylic Dryfall Flat, B42-181 Series, flat.
      - 1) at 6.0 mils wet, 1.5 mils dry.
    - b. Top Coat: Pro Industrial Waterborne Acrylic DryFall Eg-Shel, B42-82, eggshell.
      - 1) at 6.0 mils wet, 1.9 mils dry.

- G. Galvanized-Metal Substrates (where not specifically indicated to be painted):
  - 1. The Sherwin-Williams Company.
    - a. Prime Coat: Rust-inhibitive: Pro Industrial Pro-Cryl Universal Primer, B66-310 Series.
      - 1) at 5.0 to 10 mils wet, 2.0 to 4.0 mils dry.
    - b. Intermediate Coat: Matching topcoat.
    - c. Topcoat: Pro Industrial Acrylic Coating, B66-650 Series, semigloss.
      - 1) at 2.5 to 4.0 mils dry, per coat.
- H. Galvanized-Metal Ductwork Substrates:
  - 1. The Sherwin-Williams Company.
    - a. 1 coat of Pro Industrial Pro-Cryl Universal WB Acrylic Primer.
    - b. 2 coats Pro Industrial Waterborne Acrylic Dryfall.
- I. Aluminum (Not Anodized or Otherwise Coated) Substrates:
  - 1. The Sherwin-Williams Company.
    - a. Prime Coat: Rust-inhibitive: Pro Industrial Pro-Cryl Universal Primer, B66-310 Series.
      - 1) at 5.0 to 10 mils wet, 2.0 to 4.0 mils dry.
    - b. Intermediate Coat: Matching topcoat.
    - c. Topcoat: Pro Industrial Acrylic Coating, B66-650 Series, semigloss.
      - 1) at 2.5 to 4.0 mils dry, per coat.
- J. Gypsum Board Wall Substrates – Latex System:
  - 1. The Sherwin-Williams Company.
    - a. Prime Coat: ProMar 200 Zero VOC Latex Primer, B28W2600.
      - 1) at 4.0 mils wet, 1.0 mils dry.
    - b. Intermediate Coat: Matching topcoat.
    - c. Topcoat: ProMar 200 Zero VOC Latex, B20-2600 Series, eggshell.
      - 1) at 4.0 mils wet, 1.7 mils dry, per coat.
  - 2. The Sherwin-Williams Company. (For gyms, Corridors, cafeterias, and toilets).
    - a. Prime Coat: ProMar 200 Zero VOC Latex Primer, B28W2600.
      - 1) at 4.0 wet, 1.0 mils dry.
    - b. Intermediate Matching topcoat.
    - c. Topcoat: Pro Industrial Pre-Catalyzed Water Based Epoxy, K45-1151 Series, eggshell.
      - 1) at 4.0 mils wet, 1.5 mils dry, per coat.
- K. Gypsum Board Wall Substrates – Epoxy: Refer to Section 099600.
  - 1. The Sherwin-Williams Company
    - a. 1 coat ProMar 200 Zero VOC Interior Latex Primer.
    - b. 1 coat ProMar 200 Zero VOC, eggshell.
  - 2. The Sherwin-Williams Company.
    - a. Roman Adhessives.
      - 1) 1 coat Pro-977 Ultra Prime.
- L. Wood Doors (Existing):
  - 1. The Sherwin-Williams Company.
    - a. Fill damaged areas and sand smooth.
    - b. Prime Coat: PrepRite ProBlock Int./Ext. Latex Primer-Sealer, B51-600 Seireat 4.0 mils wet, 1.4 mils dry.
      - 1) at 4.0 mils wet, 1.4 mils dry.
    - c. Intermediate Coat: Matching topcoat.
    - d. Topcoat: Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series.
      - 1) at 2.5 to 4.0 mils dry, per coat.
- M. Wood Trim and Decorative Paneling (Opaque Finish):

END OF SECTION 099123

This page intentionally left blank



## SECTION 099600 - HIGH PERFORMANCE COATINGS

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section includes surface preparation and the application of high-performance coating systems on the following substrates:
  - 1. Exterior Substrates:
    - a. Steel.
    - b. Galvanized metal.
  - 2. Interior Substrates:
    - a. Cement board.
    - b. Steel.
    - c. Galvanized metal.
    - d. Gypsum board.
- B. Related Requirements:
  - 1. Section 099123 "Interior Painting" for general field painting.

#### 1.2 DEFINITIONS

- A. Gloss Level 3 "Eggshell": 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 5 "Semi-gloss": 35 to 70 units at 60 degrees, according to ASTM D 523.
- C. Gloss Level 6 "Gloss": 70 to 85 units at 60 degrees, according to ASTM D 523.
- D. Gloss Level 7 "High Gloss": More than 85 units at 60 degrees, according to ASTM D 523.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
  - 1. Indicate VOC content.
- B. Samples for Initial Selection: For each type of topcoat product indicated.
- C. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.
  - 1. Submit Samples on rigid backing, 8 inches square.
  - 2. Apply coats on Samples in steps to show each coat required for system.
  - 3. Label each coat of each Sample.
  - 4. Label each Sample for location and application area.
- D. Product List: For each product indicated, include the following:
  - 1. Cross-reference to coating system and locations of application areas.
  - 2. Use same designations indicated on Drawings and in schedules.
  - 3. Color designations.

#### 1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Coatings: One (1) gallon of each material and color applied.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
  - 1. Maintain containers in clean condition, free of foreign materials and residue.
  - 2. Remove rags and waste from storage areas daily.

## 1.6 FIELD CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
- C. Do not apply exterior coatings in snow, rain, fog, or mist.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers - Basis of Design Products: Subject to compliance with requirements, provide products by The Sherwin-Williams Company, or comparable products from other manufacturers submitted to and accepted by Architect and Owner prior to bidding.

### 2.2 HIGH-PERFORMANCE COATINGS, GENERAL

- A. Material Compatibility:
  - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
  - 3. Products shall be of same manufacturer for each coat in a coating system.
- B. VOC Content: For field applications, paints and coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits for paints and paint colorants:
  - 1. Paints and Coatings: Less than 50 g/L.
- C. Low-Emitting Materials: For field applications that are inside the weatherproofing system, 90 percent of paints and coatings 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."
- D. Colors: Where not indicated on Drawings, as selected by Architect from manufacturer's full range.
- E. Paint Systems: Refer to schedule at end of this Section.
- F. Material Finish Legend designations:
  - 1. Wall & Ceiling Finishes: 099600.A01, finishes "HP1."

### 2.3 SOURCE QUALITY CONTROL

- A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:
  - 1. Owner may engage the services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If coating materials have already been

- delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
2. Testing agency will perform tests for compliance with product requirements.
  3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
  1. Concrete: 12 percent.
  2. Fiber-Cement Board: 12 percent.
  3. Masonry (Clay and CMUs): 12 percent.
  4. Wood: 15 percent.
  5. Gypsum Board: 12 percent.
  6. Plaster: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Plaster Substrates: Verify that plaster is fully cured.
- E. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- F. Proceed with coating application only after unsatisfactory conditions have been corrected.
  1. Application of coating indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions applicable to substrates and paint systems indicated.
  1. Prepare previously painted surfaces indicated to receive new paint finish in strict accordance with paint manufacturer's written recommendations.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
  1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by paint manufacturer.
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- F. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

### 3.3 APPLICATION

- A. Apply high-performance coatings according to manufacturer's written instructions.
  - 1. Use applicators and techniques suited for coating and substrate indicated.
  - 2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
  - 3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
  - 4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- C. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
- D. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

### 3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
  - 1. Contractor shall touch up and restore coated surfaces damaged by testing.
  - 2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written recommendations.

### 3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

### 3.6 EXTERIOR HIGH-PERFORMANCE COATING SCHEDULE

- A. Galvanized Metals, Bollards and Trash Enclosure Framing:
  - 1. The Sherwin-Williams Company.
    - a. 1 coat Macropoxy 646.
    - b. 1 coat Pro Industrial WB Alkyd Urethane.
- B. Steel Substrates:
  - 1. The Sherwin-Williams Company.
    - a. 1 coat Macropoxy 646-100.
    - b. 1 coat FluoroKem HS.

### 3.7 INTERIOR HIGH-PERFORMANCE COATING SCHEDULE

- A. Steel:
  - 1. The Sherwin-Williams Company.
    - a. 1 coat Macropoxy 646-100
    - b. 1 coat Waterbased Acrolon 100 HS Acrylic Polyurethane, semi-gloss
- B. Gypsum Board Wall Substrates – Epoxy:
  - 1. The Sherwin-Williams Company.
    - a. 1 coat ProMar 200 Zero VOC Interior Primer.
    - b. 2 coats Pro Industrial Pre-Catalyzed Waterbased Epoxy, 1150 Series, single-component,
      - 1) Eggshell
- C. Gypsum Board Wall Substrates – Epoxy (wet areas):
  - 1. The Sherwin-Williams Company.
    - a. 1 coat ProMar 200 Zero VOC Interior Primer.
    - b. 2 coats Pro Industrial Zero VOC Waterborne Catalyzed Epoxy, two-component,
      - 1) Eggshell
- D. Gypsum Board Ceiling Substrates – Epoxy (wet areas):
  - 1. The Sherwin-Williams Company.
    - a. 1 coat Sherwin Williams Macropoxy 646-100.
    - b. 2 coats Pro Industrial Zero VOC Waterborne Catalyzed Epoxy, two-component,
      - 1) Eggshell

END OF SECTION 099600

This page intentionally left blank

## **SECTION 101100 - VISUAL DISPLAY UNITS**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Visual Display Wall Panels (101100.A05).

#### **1.2 PREINSTALLATION MEETINGS**

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

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.
  - 2. Include electrical characteristics for motorized units.
- B. Shop Drawings: For visual display units.
  - 1. Include plans, elevations, sections, details, and attachment to other work.
  - 2. Show locations of panel joints. Show locations of field-assembled joints for factory-fabricated units too large to ship in one piece.
  - 3. Show locations and layout of special-purpose graphics.
  - 4. Include sections of typical trim members.
  - 5. Include wiring diagrams for power and control wiring.
  - 6. Show dimensioned layout and elevation of each area, indicate number of panels for each layout.
  - 7. Include illustrations of each type of mounting system.
- C. Samples for Initial Selection: For each type of visual display unit indicated, for units with factory-applied color finishes, and as follows:
  - 1. Samples of facings for each visual display panel type, indicating color and texture.
  - 2. Actual factory-finish color samples, applied to aluminum substrate.
  - 3. Include accessory Samples to verify color selected.
- D. Samples for Verification: For each type of visual display unit indicated.
  - 1. Visual Display Panel: Not less than 8-1/2 by 11 inches, with facing, core, and backing indicated for final Work. Include one panel for each type, color, and texture required.
  - 2. Trim: 6-inch-long sections of each trim profile.
  - 3. Display Rail: 6-inch-long section of each type.
  - 4. Accessories: Full-size Sample of each type of accessory.
  - 5. Sample of magnetic glass write board in color specified, not less than 12 inches square. Include sample of one mounting device in finish selected.
  - 6. Sample of magnetic dry-erase board in color specified, not less than 12 inches square. Include sample of one mounting device.
  - 7. Perforated Hardboard (Pegboard): 2'0" long x 12" board width, complete with accessories.
- E. Product Schedule: For visual display units. Use same designations indicated on Drawings.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For qualified Installer.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for surface-burning characteristics of tackboards.

- C. Sample Warranties: For special warranties.

## 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For visual display units[ and motorized units] to include in maintenance manuals.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver factory-fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.
- B. Deliver factory-built visual display surfaces, including factory-applied trim, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site.

## 1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Verify actual dimensions of construction contiguous with visual display units by field measurements before fabrication.
  - 1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

## 1.9 WARRANTY

- A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Surfaces lose original writing and erasing qualities.
    - b. Surfaces exhibit crazing, cracking, or flaking.
  - 2. Warranty Period: Life of the building.
- B. Special Warranty for Glass Markerboard Panels: Manufacturer agrees to repair or replace glass markerboard panels that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Surfaces lose original writing and erasing qualities.
  - 2. Warranty Period: 10 years.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of visual display unit from single source from single manufacturer.



## 2.2 PERFORMANCE REQUIREMENTS

- A. 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: 25 or less.
  - 2. Smoke-Developed Index: 450 or less.
- B. 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.

## 2.3 VISUAL DISPLAY WALL PANELS (101100.A05 - **MB6**)

- A. Floor-to-Ceiling Markerboard Panel Assemblies: Consisting of markerboard panels with porcelain-enamel facing on core indicated, fabricated for floor-to-ceiling assemblies.
  - 1. Basis of Design: Subject to compliance with requirements, provide "LCS Marker Wall" by Claridge Products or one of the following manufacturers meeting the specified product characteristics:
    - a. Marsh by PolyVision.
  - 2. Color: White
  - 3. Writing Surface: Low Gloss Porcelain Enamel Steel surface recommended by manufacturer for projections. Basis of Design: "LCS<sup>3</sup>" by Claridge Products.
    - a. Color: White
    - b. Maintenance: Manufacturer's cleaning recommendations shall allow the use of non-proprietary cleaners and shall include instructions for removal of permanent markers.
    - c. Magnetic Surface: Writing surface shall be magnetic and compatible with standard magnetic document fastening products.
  - 4. Width: As indicated on Drawings.
  - 5. Height: As indicated on Drawings.
  - 6. Joint Accessories: Manufacturer's standard, concealed aluminum spline at butt joints.
  - 7. Trim: 3/4 inch face perimeter trim in clear satin anodized finish.

## 2.4 MATERIALS

- A. Adhesives for Field Application: Mildew-resistant, nonstaining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application; as recommended in writing by visual display unit manufacturer.
  - 1. Adhesives shall have a VOC content of 50 g/L or less.
- B. Clear Tempered Glass: ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality Q3, with exposed edges seamed before tempering.
- C. Dry-Erase Boards: Manufacturer's standard ghost-free and shatterproof material with optically clear hard coating on face and permanent opaque color coating on back.
- D. Extruded Aluminum: ASTM B 221, Alloy 6063.
- E. Fiberboard: ASTM C 208 cellulosic fiber insulating board.
- F. Hardboard: ANSI A135.4, tempered.
- G. High-Pressure Plastic Laminate: NEMA LD 3.
- H. Natural-Cork Sheet: Seamless, single-layer, compressed fine-grain cork sheet; bulletin board quality; face sanded for natural finish with surface-burning characteristics indicated.
- I. Medium-Density Fiberboard: ANSI A208.2, Grade 130.
- J. Particleboard: ANSI A208.1, Grade M-1.

- K. Polyester Fabric: Nondirectional weave, 100 percent polyester; weighing not less than 15 oz./sq. yd.; with surface-burning characteristics indicated.
- L. Porcelain-Enamel Face Sheet: PEI-1002, with face sheet manufacturer's standard two- or three-coat process.
- M. Vinyl Fabric: Mildew resistant, washable, complying with FS CCC-W-408D, Type II, [burlap weave] ; weighing not less than 13 oz./sq. yd.; with surface-burning characteristics indicated.

## 2.5 GENERAL FINISH REQUIREMENTS

- 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 unacceptable. 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.

## 2.6 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical power systems to verify actual locations of connections before installation of motorized, sliding visual display units.
- C. Examine walls and partitions for proper preparation and backing for visual display units.
- D. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.
- C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.
- D. Prepare recesses for sliding visual display units as required by type and size of unit.

### 3.3 INSTALLATION OF FACTORY-FABRICATED VISUAL DISPLAY BOARDS AND ASSEMBLIES

- A. Visual Display Boards: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches o.c. Secure both top and bottom of boards to walls. Do NOT

adhesively apply visual display boards to wall substrates.

#### 3.4 INSTALLATION OF FLOOR TO CEILING MARKERBOARD PANELS

- A. Floor-to-Ceiling Markerboard Panels: Attach panels to wall surface with egg-size adhesive gobs at 16 inches o.c., horizontally and vertically.
  - 1. Join adjacent panels with concealed steel splines for smooth alignment.

#### 3.5 CLEANING AND PROTECTION

- A. Clean visual display units according to manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.
- B. Touch up factory-applied finishes to restore damaged or soiled areas.
- C. Cover and protect visual display units after installation and cleaning.

#### 3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motorized, sliding visual display units.

END OF SECTION 101100

This page intentionally left blank

## **SECTION 101423 - ADA AND CODE SIGNAGE**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Wayfinding Panel Signage (101423.A01):
    - a. Interior Room signage.
    - b. Custom fabricated polymer plastic signage.
- B. Related Sections include the following:
  - 1. Section 015000 "Temporary Facilities and Controls" for temporary Project identification signs and for temporary information and directional signs.

#### **1.2 DEFINITIONS**

- A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."
- B. Signage Contractor: Contractor responsible for the fabrication and installation of signage unless responsibility for fabrication or installation is called out by others in the drawings.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated. Including but not limited to, the following:
  - 1. Manufacturer's technical product data for each type of product specified. Include data on physical characteristics, durability, fade resistance, flame resistance and manufacturing process.
  - 2. Product data shall show compliance with requirements for fire performance characteristics and physical properties.
- B. Shop Drawings: Show fabrication and installation details for signs.
  - 1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
  - 2. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.
  - 3. Include fabrication and installation details, and attachments to other work.
  - 4. Include elevations, component details, and attachments to other work for wayfinding signage.
  - 5. Indicate materials and profiles of signage fittings, joinery, finishes, fasteners, anchorages, and accessory items.
  - 6. Field Dimensions shall be obtained, reviewed, and accepted by signage manufacturer prior to submittal of shop drawings.
- C. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available for the following:
  - 1. Aluminum.
- D. Samples for Verification:
  - 1. Sample from same flitch to be used for the Work, with specified finish applied.
  - 2. Submit full-size samples of wayfinding signage. Quantity and type shall be determined by Architect with intent of one sample per each signage type representative of all types of products indicated.
- E. Sign Schedule: Use same designations indicated on Drawings.
- F. Mockups/Field Samples: Build mockups/field samples to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Warranty: Special warranty specified in this Section.
- C. Provide written documentation that the braille translation included on the manufacturer's signage provided in this section has been evaluated by the American Foundation for the Blind, and is, in their opinion, correct and compliant with ADAAG.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For signs to include in maintenance manuals.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Fabricator Qualifications: A firm that employs skilled workers experienced in producing custom-fabricated products similar to those required for this Project and with at least seven years continuous experience under the current company name. Fabricator shall have a record of successful in-service performance, as well as sufficient production capacity to produce required units.
  1. Fabricator shall have completed at least seven (7) similar signage projects having similar requirements within the last four (4) years for each signage type.
- C. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.
- D. Regulatory Requirements: Comply with applicable provisions in ICC A117.1.
- E. Fire Performance Characteristics: Provide wall coverings with the following surface burning characteristics as determined by testing identical products per ASTM E 84 by UL or other testing and inspecting organizations acceptable to authorities having jurisdiction. Identify wall coverings with appropriate markings of applicable testing and inspecting organization.
  1. Flame Spread: 5 or less.
  2. Smoke Developed: 25 or less.
- F. Accessibility Guidelines: Signage shall comply with ICC A117.1 where applicable. Characters and graphics, including but-not limited to, copy height, letter stroke symbols, materials, and finishes indicated on the Drawings are intended as guidelines for compliance. Implement each applicable ADA guideline. Should conflicts arise, notify the Designer before proceeding.

#### 1.7 PREINSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct conference at Project site.
  1. Required parties include the contractor, sub-contractor and architect/designer.
  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 temporary protection requirements for during and after installation.

#### 1.8 PROJECT CONDITIONS

- A. Field Measurements: Verify recess openings by field measurements before fabrication and indicate measurements on Shop Drawings.

## 1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install ADA and Code Signage units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F for not less than 72 hours before beginning installation and for the remainder of the construction period.

## 1.10 DELIVERY, STORAGE AND HANDLING

- A. Use special care in handling to prevent twisting, warping, nicking, and other damage to signage. Store materials to permit easy access for inspection and identification.
- B. Store signage in a well-ventilated area, away from uncured concrete and masonry, and protected from weather, moisture, soiling, abrasion, extreme temperatures, and humidity.

## 1.11 COORDINATION

- A. Coordinate placement of anchorage devices with templates for installing signs.
- B. For signage 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.

## 1.12 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Deterioration of metal and polymer finishes beyond normal weathering.
    - b. Deterioration of embedded graphic image colors.
  - 2. Warranty Period: Five years from date of Substantial Completion.

## PART 2 PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for signs.

### 2.2 MATERIALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. Provide materials without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.
  - 1. Plate and Sheet: ASTM B 209, Alloy 3003-H14, Alloy 5005-H32 or Alloy 6061-T6.
  - 2. Castings: ASTM B 26/B 26M, of alloy and temper recommended by sign manufacturer for casting process used and for use and finish indicated.
  - 3. Extrusions: ASTM B221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- C. Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

- D. PETG (Polyethylene Terephthalate Glycol) Sheet: ASTM D 5047-17 category as standard with manufacturer for each sign.
  - 1. Tensile Strength: 7,700 lbf/sq. in. per ASTM D 638.
  - 2. Flexural Modulus of Elasticity: 310,000 lbf/sq. in. per ASTM D 790.
- E. Photopolymer Sheet: Manufacturer's recommended photopolymer for producing integral non-laminated raised copy.
- F. Polycarbonate Sheet: Of thickness indicated, manufactured by extrusion process, ASTM C 1349, Appendix X1, Type II (coated, mar-resistant, UV-stabilized polycarbonate), coated on both surfaces with abrasion-resistant coating:
  - 1. Impact Resistance: 16 ft-lbf/in. per ASTM D 256, Method A.
  - 2. Tensile Strength: 9000 lbf/sq. in. per ASTM D 638.
  - 3. Flexural Modulus of Elasticity: 340,000 lbf/sq. in. per ASTM D 790.
  - 4. Heat Deflection: 265 deg F at 264 lbf/sq. in. per ASTM D 648.
  - 5. Abrasion Resistance: 1.5 percent maximum haze increase for 100 revolutions of a Taber abraser with a load of 500 g per ASTM D 1044.
- G. Expanded PVC Sheet: Subject to compliance with requirements, provide "Sintra" by 3A Composites.
  - 1. Material: Moderately expanded closed-cell polyvinyl chloride.
  - 2. Color: As selected by Architect from manufacturer's full range.
- H. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

## 2.3 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: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Aluminum Finishes
  - 1. Clear Anodic Finish: Manufacturer's standard Class 1 clear anodic coating, 0.018 mm or thicker, over a satin (directionally textured) mechanical finish, complying with AAMA 611.
- E. Acrylic Sheet Finishes
  - 1. Colored Coatings for Acrylic Sheet: For copy and background colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and that are UV and water resistant for five years for application intended.

## 2.4 ACCESSORIES

- A. Mounting Methods: Use double sided vinyl tape and silicone adhesive fabricated from materials that are not corrosive to sign materials and mounting surface.
- B. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.
  - 1. Use concealed fasteners and anchors unless indicated to be exposed.
  - 2. Exposed Metal-Fastener Components, General:
    - a. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
    - b. Fastener Heads: For nonstructural connections, use oval countersunk screws and bolts with tamper-resistant, Allen-head slots unless otherwise indicated.



## 2.5 FABRICATION

- A. General: Provide manufacturer's standard signs of configurations indicated.
  - 1. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.
  - 2. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.
  - 3. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.
  - 4. Provide rebates, lugs, and brackets necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
- B. Sign Message Panels: Construct sign-panel surfaces to be smooth and to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch (1.5 mm) measured diagonally from corner to corner.
  - 1. Increase panel thickness or reinforce with concealed stiffeners or backing materials as needed to product surfaces without distortion, buckles, warp, or other surface deformations.

## 2.6 WAYFINDING PANEL SIGNAGE – ROOM SIGNAGE (101423.A01)

- A. General: Panel signs shall be acrylic or photopolymer signs with insert window, with an overall thickness of approximately 5/16 inch. Intent is to match Existing signs. Verify signs were constructed as follows:
  - 1. Provide back sheet of 1/8 inch thick acrylic with first surface painted.
  - 2. Provide 1/16 inch spacer for insert window.
  - 3. Provide 1/8 inch thick photopolymer with first surface painted.
  - 4. Provide painted edges for solid appearance.
  - 5. Provide white raised numbers and braille, unless otherwise indicated or required by code.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Ad Trends.
  - 2. APCO Signs.
  - 3. ASI Sign Systems, Inc.
  - 4. Fast Signs.
  - 5. Gemini.
  - 6. Howard Industries.
  - 7. Innerface Architectural Signage, Inc.
  - 8. Modulex.
  - 9. Nova Polymers.
  - 10. Star Signs.
  - 11. Take Form.
  - 12. 2/90 Sign Systems.
- C. Interior Panel Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner.
- D. Changeable Message Inserts: Fabricate signs to allow insertion of changeable messages in the form of slide-in inserts.
- E. Tactile and Braille Sign: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Text shall be accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.
  - 1. Raised-Copy Thickness: Not less than 1/32 inch.
- F. Subsurface Copy: Apply minimum 4-mil- thick vinyl copy to back face of clear acrylic sheet forming panel face to produce precisely formed opaque image. Image shall be free of rough edges.
- G. Colored Coatings for Acrylic Sheet: For copy background colors, provide colored coatings, including inks, dyes, and paints, that are recommended by acrylic manufacturers for optimum adherence to acrylic surface and are UV and water resistant for five years for application intended.

1. Color: As selected by Architect from manufacturer's full range.
- H. Sign Types – General: Provide Tactile/Braille to meet ADA requirements. Match existing interior signage to best extent possible as acceptable to Architect.

## 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 work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs.
- C. Verify that anchor inserts are correctly sized and located to accommodate signs.
- D. Verify that items provided under other sections of Work are sized and located to accommodate signs.
- E. Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with authorities having jurisdiction and are free from dirt and other deleterious matter.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.
- G. Field verify dimensions of all conditions.

### 3.2 INSTALLATION, GENERAL

- A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.
  1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
  2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.
- B. Wall-Mounted Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.
- C. Wall-Mounted Signs on Smooth Surfaces: Comply with sign manufacturer's written instructions except where more stringent requirements apply.
  1. Silicone-Adhesive Mounting: Attach signs to irregular, porous, or vinyl-covered surfaces. Where signage is located on exterior surfaces, provide exterior rated adhesive as recommended by signage manufacturer for substrate indicated.
- D. Wall-Mounted Signs on Textured Surfaces: Comply with sign manufacturer's written instructions except where more stringent requirements apply. Mount characters using standard fastening methods to comply with manufacturer's written instructions for character form, type of mounting, wall construction, and condition of exposure indicated. Provide heavy paper template to establish character spacing and to locate holes for fasteners.
  1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
    - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
    - b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
- E. Vertical Tolerance: Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1m)

### 3.3 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.
- B. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes to components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- C. Remove temporary protective coverings and strippable films as signs are installed.
- D. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean conditions during construction and protect from damage until acceptance by Owner.

END OF SECTION 101423

This page intentionally left blank

## **SECTION 102600 - WALL AND DOOR PROTECTION**

### **PART 1 GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Stainless Steel Corner Guards (102600.A03 - CG1).
- B. Related Requirements:
  - 1. Section 087100 "Door Hardware" for metal armor, kick, mop, and push plates.
  - 2. Section 092900 "Gypsum Board" for corner trim included in gypsum board installation.

#### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.
  - 2. Include fire ratings of units recessed in fire-rated walls and listings for door-protection items attached to fire-rated doors.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available for each type of impact-resistant wall-protection unit indicated.
  - 1. Include Samples of accent strips and accessories to verify color selection.
  - 2. Digital Protective Wallcovering – submit a sample of each wall graphic type in the form of small-scale color proofs for each graphic or mural.
- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
  - 1. Corner Guards: 12 inches long.
  - 2. Custom Printed Wall Graphic on Abuse Resistant Wall coverings: Provide sample of wallcovering containing printed graphic using artwork provided by Architect. Before printing, prepare full-color proofs which include a full-scale sample, as well as a reduced sample of the entire graphic for each wall graphic for the Architect's approval. Approved proof will set quality standards for graphic and aesthetic effect.
    - a. Sample size to be no less than 2'-0" to 4'-0" square or as otherwise indicated.
    - b. Sample area as indicated by Architect during proofs.
    - c. When wall graphic is divided into separate sections, provide separate proof of each section.
    - d. Samples to show color, texture, pattern, and thickness.
    - e. Sample of each product specified.

#### **1.3 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For each impact-resistant wall protection unit to include in maintenance manuals.
  - 1. Include recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.

#### **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.
- B. Include mounting and accessory components. Replacement materials shall be from same production run as installed units.

## 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.
- B. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall protection units and are based on the specific system indicated. Refer to Section 01 40 00 "Quality 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.
- C. Preinstallation Conference: Conduct conference at Project site.

## 1.6 MOCKUPS

- A. Mockups/Field Samples: Build mockups/field samples, to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
  - 1. Field Samples: Build field sample/mockup of typical wall areas as shown on Drawings.
    - a. Note: Mockup shall be a field sample of corner guard, baseboard, and adjacent areas in Project. Architect and manufacturer's representative will observe installation of first corner guard installation at Architect's selected location.
- B. Field testing shall be performed on field sample areas according to requirements in "Field Quality Control" Article.
- C. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
  - 1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.

## 1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and HVAC system is operating and maintaining temperature at 70 deg F for not less than 72 hours before beginning installation and for the remainder of the construction period.

## PART 2 PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Surface Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 450 or less.

### 2.2 STAINLESS STEEL CORNER GUARDS (102600.A03 - **CG1**)

- A. Surface-Mounted, Stainless Steel Corner Guards (102600.A03): ASTM A240, Type 304, 16 gauge with #4 satin finish

- B. Basis-of-Design Product: Provide Stainless Steel Corner Guards by Inpro or approved product with the following characteristics.
  - 1. Description:
    - a. 2" x 2" x 90 degree surface mounted stainless steel corner guard with 1/8" radius corner.
    - b. Height shall be 8 feet, unless indicated otherwise.
  - 2. Mechanical Fasteners: Stainless steel #6 x 1-1/2" countersunk sheet metal screws

## 2.3 MATERIALS

- A. Fasteners: Nonmagnetic stainless-steel metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.
- B. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.
- C. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.
- D. Adhesive: As recommended by protection product manufacturer.
- E. Aluminum Extrusions: Alloy and temper recommended by manufacturer for type of use and finish indicated, but with not less than strength and durability properties specified in ASTM B 221 for Alloy 6063-T5.
- F. Stainless-Steel Sheet: ASTM A 240/A 240M.
- G. PETG (Polyethylene Terephthalate Glycol):
  - 1. Impact Resistance: Minimum 10 kj.m2 when tested according to ISO 180.
  - 2. Chemical and Stain Resistance: Tested in accordance with ASTM D543.
  - 3. Flame-Spread Index: 25 or less.
  - 4. Smoke-Developed Index: 450 or less.
- H. Galvanized-Steel Sheet: ASTM A 653/A 653M, G90 coating, either commercial steel, Type B, or structural steel, Grade 33, unless another grade is required by design loads.

## 2.4 FABRICATION

- A. Fabricate impact-resistant wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.
  - 1. Provide surfaces free of chips, dents, and other imperfections.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components. Before installation, clean substrate to remove dust, debris, and loose particles.

### 3.3 INSTALLATION AND CLEANING

- A. General: Install impact-resistant wall protection units plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
  - 1. Install wall protection units in locations and at mounting heights indicated on Drawings.
  - 2. Provide mounting hardware, anchors, and other accessories required for a complete installation.
    - a. Provide anchoring devices to withstand imposed loads.
- B. Immediately after completion of installation, clean plastic covers and accessories as recommended by corner guard manufacturer.
- C. Stainless Steel Corner Guards: Install corner guards using countersunk oval head mechanical fasteners and supplement with manufactures recommended adhesive. Corner guard edges to be flush with adjacent wall to allow for no gapping.

END OF SECTION 102600



## **SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES**

### **TOILET, BATH, AND LAUNDRY ACCESSORIES**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Public-use washroom accessories.
    - a. Toilet Tissue Dispenser (102800.A01).
    - b. Paper Towel Dispenser (102800.A02).
    - c. Soap Dispenser (102800.A05).
    - d. Grab Bar (102800.A06).
    - e. Sanitary Napkin Receptor Unit (SNR) (102800.A08).
    - f. Mirror Unit (102800.A10).
  - 2. Public-use shower room accessories:
    - a. Coat Hook (102800.A15).
  - 3. Accessories:
    - a. Under Lavatory guards (102800.A21).
- B. Related Sections:
  - 1. Section 061000 "Rough Carpentry" for blocking required behind fixtures and accessories.
  - 2. Section 102113 "Toilet Compartments".
  - 3. Section 102116 "Shower & Dressing Compartments".
  - 4. Division 26 for electrical requirements for illuminated mirror units and warm air dryers.
- C. Owner will furnish, and contractor install the following accessories:
  - 1. Toilet tissue dispensers
  - 2. Paper towel dispensers.
  - 3. Soap dispensers.
- D. Owner will furnish and install the following accessories:
  - 1. Waste receptacles.

#### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated. Include the following:
  - 1. Construction details and dimensions.
  - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
  - 3. Material and finish descriptions.
  - 4. Features that will be included for Project.
  - 5. Manufacturer's warranty.
  - 6. Include electrical characteristics.
- B. Samples: Full size, for each accessory item to verify design, operation, and finish requirements.
  - 1. Approved full-size Samples will be returned and may be used in the Work.
- C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
  - 1. Identify locations using room designations indicated.
  - 2. Identify products using designations indicated.

#### **1.3 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.
- B. Warranty: Sample of special warranty.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

#### 1.5 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.
  - 1. Where cutouts are required in other work, provide templates, substrate preparation instructions, and directions for preparing cutouts and for installation of anchorage devices.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

#### 1.6 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, visible silver spoilage defects.
  - 2. Warranty Period: 15 years from date of Substantial Completion.

### 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 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch 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 minimum nominal thickness.
- D. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 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.
- I. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

#### 2.3 PUBLIC-USE WASHROOM ACCESSORIES

- A. Toilet Tissue Dispenser (102800.A01 - TTD) – Provided by Owner, Installed by Contractor.

- B. Paper Towel Dispenser (102800.A02 - PTD) – Provided by Owner, Installed by Contractor.
- C. Soap Dispenser (102800.A05 - SD) – Provided by Owner, Installed by Contractor.
- D. Grab Bars – GB, VGB, FGB (102800.A06):
  - 1. Bobrick:
    - a. B-6806.99; 36" 42" & 18" at Accessible Toilet Stalls.
    - b. B-6806.99; 18" & B-5861.99 at Shower.
    - c. B-6806.99; Series Wall-to-Floor Bar w/ bottom rail at DFs w/out Alcove.
    - d. FGB: B-4998.99 at Accessible Toilet and Shower Stall.
    - e. B-819298 Drinking Fountain Grab Bar; 33" height, projects 18" from the wall.
  - 2. Bradley:
    - a. 832-2 Series; 36" 42" & 18" at Accessible Toilet Stalls.
    - b. 832-2 Series; 18" & 16"x30" Horizontal Two-Wall Bar at Shower Stall.
    - c. 832-2 Series; Wall-to-Floor Bar w/ bottom rail at DFs w/out Alcove.
    - d. FGB: 8370-107-2 at Accessible Toilet and Shower Stall.
  - 3. ASI:
    - a. 3800-P Series; Type 01 36" 42" & 18" at Accessible Toilet Stalls.
    - b. 3800-P Series; Type 01 18" & Type 60 at Shower Stall.
    - c. 3800-P Series; Type 75 at Drinking Fountains without Alcove.
    - d. FGB: 3413-P at Accessible Toilet and Shower Stall.
- E. Sanitary-Napkin Receptor Unit (102800.A08 - SNR):
  - 1. Basis of Design Products:
    - a. Bradley: Model 4721-15 & 4722-15.
    - b. ASI: Model 0473-1A & 0472-1.
  - 2. Mounting: Surface.
  - 3. Door or Cover: Self-closing, disposal-opening cover and hinged face panel with tumbler lockset.
  - 4. Receptacle: Removable.
  - 5. Material and Finish: Stainless steel, No. 4 finish (satin).
- F. Mirror Unit (102800.A10 – M1, M3):
  - 1. Basis-of-Design Products:
    - a. Bobrick Washroom Equipment, Inc.; B-290 Series.
    - b. ASI: Model 0600.
  - 2. Types:
    - a. M1 – Shall be 24-inches wide x 42 -inches height.
  - 3. Frame Stainless-steel channel, in No.4 satin finish.
  - 4. Hangers: Produce rigid, tamper- and theft-resistant installation, using method indicated below.
    - a. Concealed wall hanger bracket of galvanized steel, equipped with concealed locking devices requiring a special tool to remove.
    - b. One-piece, galvanized-steel, wall-hanger device with spring-action locking mechanism to hold mirror unit in position with no exposed screws or bolts.
  - 5. Glazing: Provide polished tempered glass mirror in locker rooms and gym facilities. Provide polished non-tempered glass mirror in other locations unless noted otherwise.
  - 6. Sizes: As indicated on Drawings.

## 2.4 PUBLIC-USE SHOWER ROOM ACCESSORIES

- A. Source Limitations: Obtain public-use shower room accessories from single source from single manufacturer.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product specified or comparable product by one of the following:
  - 1. American Specialties, Inc.
  - 2. Bradley Corporation.
- C. Coat Hook (102800.A15):
  - 1. Description: Double-prong unit.
  - 2. Material and Finish: Stainless steel, No. 4 finish (satin).
  - 3. Basis-of-Design Product: Bobrick; Model B-6727.

## 2.5 UNDER-LAVATORY GUARDS

- A. Under-lavatory Guard (102800.A21):
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Plumberex Specialty Products, Inc.
    - b. Truebro by IPS Corporation.
  - 2. Description: Insulating pipe covering for supply and drain piping assemblies that prevents direct contact with and burns from piping; allow service access without removing coverings.
  - 3. Material and Finish: Antimicrobial, molded plastic, white.

## 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 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 recommendations.

END OF SECTION 102800

## SECTION 116623 - GYMNASIUM EQUIPMENT

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Wall/Safety pads (116623.A07).
    - a. Wall Mounted.
  - 2. Platform Swing (116623.A13).
- B. Related Requirements:
  - 1. Section 012100 "Allowances" for allowances related to work of this Section.
  - 2. Section 012200 "Unit Prices" for unit prices related to work of this Section.
  - 3. Section 061000 "Rough Carpentry"

#### 1.2 DEFINITIONS

- A. NFHS: National Federation of State High School Associations.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. If applicable, include assembly, disassembly, and storage instructions for removable equipment.
  - 2. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.
- B. Shop Drawings: For each type of equipment specified.
  - 1. Include plans and layouts, elevations, sections, details, and attachments to other work.
  - 2. Include details of field assembly for removable equipment, connections, installation, mountings, floor inserts, attachments to other work, and operational clearances.
  - 3. Include transport and storage accessories for removable equipment.
- C. Samples for Initial Selection: For each type of athletic equipment, scoreboard and scorer's table.
  - 1. Color sample chips for each item requiring color selections.
- D. Wiring Diagrams: Submit wiring diagrams for each item of Gymnasium Equipment requiring electricity, clearly indicate power, signal, and control wiring. Clearly differentiate between manufacturer-installed wiring and field-installed wiring. Indicate maximum and average power demands.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation including loads, point reactions, and locations for attachment of gymnasium equipment to structure.
- B. Coordination Drawings: Coordination Drawings: Court layout plans, reflected ceiling plans, and other details, drawn to scale, and coordinated with ceiling-suspended gymnasium equipment, floor inserts, game lines, and markers applied to finished flooring, and coordinated with each other, using input from installers of the items involved:
  - 1. Structural members to which overhead-supported gymnasium equipment will be attached.
  - 2. Suspended ceiling components, if any.
  - 3. Items supported from building structure above the courts, including the following:
    - a. Air outlets and inlets.
    - b. Acoustical treatments or panels.
    - c. Access panels.
- C. Qualification Data: For Installer and professional engineer.

- D. Product Certificates: For each type of gymnasium equipment.
- E. Field quality-control reports.
- F. Sample Warranty: For special warranty.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For gymnasium equipment to include in emergency, operation, and maintenance manuals.
- B. Maintenance data for inclusion in Operating and Maintenance Manual specified in Section 017823 including detailed instructions indicating proper means for operating and maintaining each type of athletic equipment item and accessory required.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Manufacturer shall have a minimum of ten (10) years continuous experience, under the current company name in the manufacturing of systems similar in complexity to those required for this Project.
- B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer, in addition to the following:
  - 1. Installer shall have at least three (3) years successful experience installing products of similar type and quality as required on this project.
- C. Source Limitations: Obtain each type of gymnasium equipment through one source from a single manufacturer.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Product/Material Qualifications: Manufacturer's catalog numbers are indicated for convenience in identifying equipment items. Unless otherwise indicated, catalog description for indicated number constitutes minimum standards of quality, design, and performance required for each item to be incorporated into the Project. Substitutions will be allowed, but must be submitted in accordance with the procedures set forth in Sections 012500 and 016000. All proposed substitutions/comparable products must be submitted to and accepted by the Architect prior to bidding.
  - 1. It will be the responsibility of the Bidder to furnish with his Bid a list clarifying any deviations from these specifications written or implied, in order that a fair and proper evaluation be made. Those Bidders not submitting a list of deviations will be presumed to have Bid as specified.

#### 1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install gymnasium equipment until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Check actual dimensions of construction affecting Athletic Equipment installation by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrications schedule with construction progress to avoid delay of Work.
  - 1. Verify position and elevation of floor inserts and layout for gymnasium equipment.

#### 1.8 COORDINATION

- A. Coordinate installation of floor inserts with structural floors and finish flooring installation and with court layout and game lines and markers on finish flooring.

- B. Coordinate layout and installation of overhead-supported gymnasium equipment and suspension-system components with other construction including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.
- C. Coordinate electrical requirements of athletic equipment with related trades.

## 1.9 WARRANTY

- A. Special Warranty for SPED Equipment: Manufacturer agrees to repair or replace components of ceiling mounted track system equipment that fail in materials or workmanship within specified warranty period.

## 1.10 SERVICE GUARANTEE

- A. The Equipment Contractor shall guarantee service and repair to any defective equipment within 24 hours from notification by Owner for a period of one (1) year after substantial completion.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS, GENERAL

- A. Source Limitations: Obtain each type of gymnasium equipment from single source from single manufacturer.

### 2.2 WALL-MOUNTED SAFETY PADDING (116623.A07)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Porter Athletics, Inc; "DuraSafe", Series **5601**; or comparable product by one of the following, meeting specified requirements, submitted to and accepted by Architect prior to bidding:
  1. Dollamur Sport Surfaces.
  2. Draper.
- B. Performance Characteristics:
  1. Impact and Shock Absorption: Units shall meet or exceed ASTM F 2440-04 requirements.
  2. Safety Pad Surface-Burning Characteristics: Shall meet NFPA 286 or another testing and inspecting agency acceptable to authorities having jurisdiction:
    - a. Unit shall meet Class A requirements for flame spread and smoke developed.
- C. Wall Pads: Panels will be constructed of 2" thick foam bonded to 7/16" oriented strand board, with 19 ounce vinyl-coated nylon fabric, folded and stapled securely to back of plywood. Mount to wall with manufacturer's standard seamless Z-clips. Panels shall be self-edged and have NO nailing margins.
  1. Size: 2'-0" width x 5'-10" height.
  2. Installation Method: Manufacturer's standard, Z-clip installation.
  3. Vinyl Covering:
    - a. Face Weight: 19 ounces.
    - b. Heavy fire-retardant, high tensile, vinyl-coated polyester fabric material. Cover material shall have a tensile strength of 100 psi, minimum.
    - c. Cover material shall be mildew and rot resistant and fortified with an infection combating fungicide.
    - d. Vinyl Covering Color: As selected by Architect from manufacturer's full range for one color.
  4. Where cut-out occur within padding, provide manufacturer's wall pad sleeves and molded inserts for outlets and switches. Depth to match adjacent pad thickness. Color shall be gray.
  5. All cutouts in panels shall be made in field to fit job conditions. All cut edges will have factory furnished applied seal or field-installed sleeves.
  6. Where safety pads are indicated to be installed over doors, fabricate pads to be 1 inch less than door the door width to allow for unencumbered operation. Contractor's option to provide a single safety pad or two separate safety pads to cover the door.
- D. Panels must be inspected before installed. CAUTION: To minimize wrinkles in fabric of installed panels, wall must be either perfectly plumb, or slightly convex (bowed out) over the area to be covered. If found to be

concave (bowed in), install sufficient shims at mid-section of panels to provide plumb or convex wall profile.

- E. The installing Contractor shall be responsible for proper inspection and installation of all panels. Installation shall be made in accordance with current factory suggested procedures.
- F. Warranty: 5 years.

## 2.3 PLATFORM SWING

- A. Platform swing shall be "Platform Swing 1800" by Southpaw Enterprises Inc. Comparable products from other manufacturers will be considered when submitted to and accepted by Architect prior to bidding.
  - 1. Contractor to provide and install mounting system. Swing to be provided by Owner.
  - 2. Accessories:
    - a. Southpaw 5000 Height Adjuster.
    - b. Southpaw 2000 Safety Rotational Device.
    - c. Prefab Joist Installation Kit #7051.

## 2.4 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for use and finish type indicated.
  - 1. Extruded Bars, Profiles, and Tubes: ASTM B 221.
  - 2. Cast Aluminum: ASTM B 179.
  - 3. Flat Sheet: ASTM B 209.
- B. Steel: Comply with the following:
  - 1. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
  - 2. Steel Tubing: ASTM A 500/A 500M or ASTM A 513, cold formed.
  - 3. Steel Sheet: ASTM A 1011/A 1011M.
- C. Support Cable: Manufacturer's standard galvanized-stranded-steel wire rope. Provide fittings complying with wire rope manufacturer's written instructions for size, number, and installation method.
- D. Support Chain and Fittings: For chains used for overhead lifting, provide Grade 80 heat-treated alloy steel chains, complying with ASTM A 391/A 391M, with commercial-quality, hot-dip galvanized steel connectors and hangars.
- E. General-Purpose Chain: For chains not used for overhead lifting, provide carbon steel chain, complying with ASTM A 413/A 413M, Grade 30 proof coil chain or other grade recommended by gymnasium equipment manufacturer. Provide coating type, chain size, number, and installation method complying with manufacturer's written instructions.
- F. Castings and Hangers: Malleable iron, complying with ASTM A 47/A 47M; grade required for structural loading.
- G. Softwood Plywood: DOC PS 1, exterior.
- H. Particleboard: ANSI A208.1; made with binder containing no urea formaldehyde.
- I. Equipment Wall-Mounted Board: Wood, neutral-color-painted finish, size, and quantity as required to mount gymnasium equipment according to manufacturer's written instructions.
- J. Anchors, Fasteners, Fittings, and Hardware: Manufacturer's standard corrosion-resistant or noncorrodible units; concealed; tamperproof, vandal- and theft-resistant design when within 8 feet of finished floor.
- K. Grout: Nonshrink, nonmetallic, premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C 1107/C 1107 with minimum strength recommended in writing by gymnasium equipment manufacturer.



## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for play court layout, alignment of mounting substrates, installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance of the Work.
  - 1. Verify critical dimensions.
  - 2. Examine supporting structure, subfloors, and footings below finished floor.
  - 3. Examine wall assemblies, where reinforced to receive anchors and fasteners, to verify that locations of concealed reinforcements are clearly marked. Locate reinforcements and mark locations.
  - 4. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. General: Comply with manufacturer's written installation instructions and competition rules indicated for each type of gymnasium equipment. Complete equipment field assembly where required.
- B. Unless otherwise indicated, install gymnasium equipment after other finishing operations, including painting, are completed.
- C. Permanently Placed Gymnasium Equipment and Components: Install rigid, level, plumb, square, and true; anchored securely to supporting structure; positioned at locations and elevations indicated; in proper relation to adjacent construction; and aligned with court layout.
  - 1. Operating Gymnasium Equipment: Verify clearances for movable components of gymnasium equipment throughout entire range of operation and for access to operating components.
- D. Platform Swing:
  - 1. General: Install swing in accordance with the manufacturer's recommendations and approved shop drawings. Set wall swing plumb, true and level, and secure anchored in place.
- E. Anchoring to In-Place Construction: Use anchors and fasteners where necessary to secure built-in and permanently placed gymnasium equipment to structural support and to properly transfer load to in-place construction.
- F. Connections: Connect electric operators to building electrical system.

### 3.3 ADJUSTING

- A. Adjust movable components of gymnasium equipment to operate safely, smoothly, easily, and quietly; free from binding, warp, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range; and lubricate as recommended in writing by manufacturer.
- B. Remove packaging and other debris from the project site.

### 3.4 CLEANING

- A. After completing gymnasium equipment installation, inspect components. Remove spots, dirt, and debris and touch up damaged shop-applied finishes according to manufacturer's written instructions.
- B. Replace gymnasium equipment and finishes that cannot be cleaned and repaired, in a manner approved by Architect, before time of Substantial Completion.

### 3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain gymnasium equipment.

END OF SECTION 116623

## SECTION 123200 - MANUFACTURED WOOD CASEWORK

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Plastic-laminate-faced wood cabinets of stock design.
  - 2. Cubbie Type 1 (123200.A46).
  - 3. Cubbie Type 2 (123200.A47).
  - 4. Filler (123200.A81).
  - 5. Finished End (123200.A82).
  - 6. End Panel (123200.A83).
- B. Related Sections:
  - 1. Section 061000 "Rough Carpentry" for wood blocking for anchoring manufactured wood casework.
  - 2. Section 096513 "Resilient Base and Accessories" for resilient base applied to manufactured wood casework.

#### 1.2 DEFINITIONS

- A. Definitions in the AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" apply to the work of this Section.
- B. Balanced Construction: Where exposed face of a panel is surfaced with high pressure plastic laminate and the opposite (back) surface shall receive a balanced product equal in thickness to the face of the panel.
  - 1. Note: Color for interior is not required to match color and pattern of exterior face laminate.
- C. Casework: Modular casework of this Section is that which is pre-manufactured to standard dimensions or sizes. Casework fabricated as part of Section 064023 "Interior Architectural Woodwork" is that which is custom fabricated to suit a particular project.
- D. Concealed Portions of Cabinets: Surfaces not usually visible after installation, including sleepers, web frames, dust panels, and ends and backs that are placed directly against walls or other cabinets.
- E. MDF: Medium-density fiberboard.
- F. Hardwood Plywood: A panel product composed of layers or plies of veneer, or of veneers in combination with lumber core, hardboard core, MDF core, or particleboard core, joined with adhesive, and faced both front and back with hardwood veneers.
- G. Exposed Portions of Cabinets: Surfaces visible when doors and drawers are closed, including bottoms of cabinets more than 48 inches above floor, and surfaces visible in open cabinets and behind glass doors.
  - 1. Ends of cabinets installed directly against walls or other cabinets shall not be considered as exposed.
- H. Semi-exposed Portions of Cabinets: Surfaces behind opaque doors, such as interiors of cabinets, shelves, dividers, interiors and sides of drawers, and interior faces of doors. Tops of cases 78 inches or more above floor are defined as semi-exposed.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, submit data describing materials, fabrication, hardware accessories, and installation instructions.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Indicate types, sizes and finishes of cabinets and countertops.
  - 2. Indicate types and locations of hardware.
  - 3. Indicate locations and types of service fittings.

4. Show fabrication details; including locations and sizes for cutouts and holes for plumbing fixtures, science equipment and other items installed in casework.
5. Indicate locations of blocking and reinforcements required for installing casework.
6. Include details of utility spaces showing supports for conduits and piping.
7. Show installation details, including field joints and filler panels.
8. Indicate locations of and clearances from adjacent walls, doors, windows, and other building components.
9. As applicable, indicate manufacturer's catalog numbers for casework.

C. Samples for Initial Selection: For cabinet finishes and for each type of top material indicated.

D. Samples for Verification: 8-by-10-inch Samples for each type of finish, including top material.

1. Exposed hardware, one unit for each type.

#### 1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer. Furnish qualification data for Installer, if different from manufacturer.

B. Keying Schedule: Include schematic keying diagram and index each key set to unique designations that are coordinated with the Contract Documents.

C. Certifications: Submit documentation verifying use of "No added formaldehyde" and "marine grade plywood" were incorporated into the work of this Section, as acceptable to and when requested by Architect.

D. Warranty: Sample of special warranty.

#### 1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer with not less than seven years of successful experience, under the current company name, in producing manufactured casework similar to that required for this Project.

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.

D. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project. Installer must have completed projects of similar size and scope to this project in the last 5 years.

E. Source Limitations: Obtain manufactured wood casework from single source from single manufacturer.

F. Quality Standard: Unless otherwise indicated, comply with the AWI's and WI's "Architectural Woodwork Standards" for grades of casework indicated for construction, finishes, installation, and other requirements.

1. Grade: Custom.

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.

G. Product Designations: Drawings indicate sizes, configurations, and finish material of manufactured wood casework. Other manufacturers' casework of similar sizes and door and drawer configurations, of same finish material, and complying with the Specifications may be considered as noted below. Refer to Section 012500 "Substitution Procedures" and Section 016000 "Product Requirements."

1. Other manufacturers proposing comparable products shall submit the following for Architect's verification:
  - a. One full-size finished base cabinet complete with hardware, doors, and drawers.
  - b. One full-size finished wall cabinet complete with hardware, doors, and adjustable shelves.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver manufactured wood casework only after painting, utility roughing-in, and similar operations that could damage, soil, or deteriorate casework have been completed in installation areas. If casework must be stored in

other than installation areas, store only in areas where environmental conditions meet requirements specified in "Project Conditions" Article.

- B. Keep finished surfaces covered with polyethylene film or other protective covering during handling and installation.

## 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install manufactured wood casework until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Verify actual dimensions of construction contiguous with manufactured wood casework by field measurements before fabrication.
  - 1. Casework manufacturer is responsible for details and dimensions not controlled by job conditions. Show all required field measurements beyond manufacturer's control on shop drawings.
  - 2. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before being enclosed, and indicate measurements on Shop Drawings.

## 1.8 COORDINATION

- A. Coordinate layout and installation of framing and reinforcements in walls and partitions for support of manufactured wood casework.
- B. Coordinate installation of laboratory casework with installation of fume hoods and other laboratory equipment.
- C. Coordinate layout and installation of work of this Section with electrical and plumbing contractors. Coordinate installation so as not to interfere with plumbing and electrical work associated with casework.
- D. Keying Conference: Conduct conference at Project site. Incorporate keying conference decisions into final keying requirements.

## 1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of manufactured wood casework that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Delamination of components or other failures of glue bond.
    - b. Warping of components.
    - c. Failure of operating hardware.
    - d. Deterioration of finishes.
  - 2. Warranty Period: Three years from date of Substantial Completion.

## PART 2- PRODUCTS

### 2.1 PLASTIC LAMINATE FACED CASEWORK MANUFACTURERS

- A. Manufacturers for Plastic-Laminate-Faced Manufactured Casework: Subject to compliance with requirements, provide products by one of the following:
  - 1. Basis-of-Design Product: Casework as manufactured by TMI Systems Design Corporation.
  - 2. Other Manufacturers: Manufacturers list below are required to meet requirements set forth in this Section. Manufacturing procedures may need to be modified for compliance and technical data on casework construction must be submitted for verification. Other manufactures include, but are not limited to:
    - a. Case Systems.
    - b. LSI
    - c. Precision Craft.

## 2.2 PLASTIC-LAMINATE-CLAD CASEWORK

- A. Drawings indicate sizes, configurations, and finish material of manufactured wood casework from Stevens Industries. Models selected include, but are not limited to, the following:
  - 1. Cubbie Type 1 (123200.A46).
    - a. #24226 - 59 inch high by 36 inch wide with 11 inch wide compartments (21 compartments).
  - 2. Cubbie Type 2 (123200.A47).
    - a. #24239 - 59 inch high by 48 inch wide with 11 inch wide compartments (28 compartments).
  - 3. Filler (123200.A81).
    - a. #10803.
    - b. #10805.
    - c. #15803.
  - 4. Finished End (123200.A82).
  - 5. End Panel (123200.A83).
    - a. #10954.
- B. Source Limitations: Obtain plastic-laminate-faced cabinets from single manufacturer.

## 2.3 MATERIALS, GENERAL

- A. Maximum Moisture Content for Lumber: 7 percent for hardwood and 12 percent for softwood.
- B. Softwood Plywood: DOC PS 1, with no added formaldehyde (NAUF).
- C. Particleboard: ANSI A208.1, Grade M-2, with no added formaldehyde (NAUF).
- D. MDF: ANSI A208.2, Grade 130, with no added formaldehyde (NAUF).
- E. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3.
  - 1. Colors: Refer to Material Finish Legend on drawings for basis of design products.
- F. Thermoset Decorative Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
- G. Edge Banding for Plastic Laminate: Rigid PVC extrusions, through color with satin finish, 3 mm thick at doors, drawer fronts and laminate countertops, 1 mm thick elsewhere.
  - 1. 3mm edge banding shall be machine-applied and set with hot-melt glue.
  - 2. Edge banding colors shall match a solid color of adjacent laminate surface, unless noted otherwise, as determined by Architect. Colors shall not be limited to casework manufacturer's standard stocked colors, but will be selected by Architect from any color group offered by Canplast, Rehau and Doellken-Woodtape.
- H. Edgebanding for Thermoset Decorative Panels: Unless otherwise specified, provide PVC or polyester edge banding complying with LMA EDG-1 and matching thermoset decorative panels.
- I. Adhesives: Use adhesives that meet 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."

## 2.4 CABINET MATERIALS

- A. Exposed Cabinet Materials:
  - 1. Plastic Laminate: Grade HGS for horizontal surfaces and VGS for vertical surfaces.
  - 2. Unless otherwise indicated, provide specified edge banding on all exposed edges.
- B. Semiexposed Cabinet Materials:
  - 1. Plastic Laminate: Grade VGS.
    - a. Provide plastic laminate for semi-exposed surfaces unless otherwise indicated.

- 1) Color for backs of doors and drawers shall match a solid color of that of cabinet box interior, as determined by Architect. Facings shall be balanced as required by AWI construction guidelines for grade level indicated.
  2. Unless otherwise indicated, provide specified edge banding on all semi-exposed edges.
- C. Concealed Cabinet Materials:
1. Thermoset decorative panels.

## 2.5 DESIGN, COLOR, AND FINISH

- A. Design: Provide manufactured wood casework of the following design:
1. Flush overlay.
- B. Thermoset Decorative Panel Colors, Patterns, and Finishes: As selected by Architect from casework manufacturer's full range.
- C. Plastic-Laminate Colors, Patterns, and Finishes: As indicated by manufacturer's designations on Drawings.
- D. PVC Edgebanding Color: As selected from casework manufacturer's full range, including pre-formulated colors.

## 2.6 CABINET FABRICATION

- A. Plastic-Laminate-Faced Cabinet Construction: As required by referenced quality standard, but not less than the following:
1. Assembly method for cabinets shall utilize "European" assembly screws (threaded steel dowel pins), similar to Hafele "Conformat". At manufacturer's option, alternate doweled assembly methods may be used if in accordance with AWI guidelines and requirements for grade level indicated.
  2. Cabinets boxes below sinks shall be fabricated from plywood and shall receive white plastic laminate on the interior.
  3. Bottoms and Ends of Cabinets, and Tops of Wall Cabinets and Tall Cabinets: 3/4-inch particleboard, plastic-laminate faced on exposed surfaces, thermoset decorative panels on semi-exposed surfaces.
  4. Shelves: Thermoset decorative panels; 3/4-inch thick for spans up to 32 inches and 1-inch thick for spans up to 48 inches.
  5. Open Shelves: 3/4-inch particleboard, plastic-laminate faced on exposed surfaces for spans up to 32 inches and 1-inch thick for spans up to 48 inches.
  6. Backs of Cabinets: 1/2-inch particleboard or 1/4-inch MDF, plastic-laminate faced on exposed surfaces, thermoset decorative panels on semi-exposed surfaces. Backs shall be captured in a 1/2-inch dado and set back 3/4-inch to accommodate 3/4-inch thick nailers.
  7. Cabinets Bases: Bases shall be fabricated separate from cabinets (not integral). Fabricate from 3/4-inch exterior marine grade plywood or preservative-treated 2x4's with marine-grade plywood face. Fabricate in a ladder configuration with plywood fronts and back running continuous for the length of the cabinet. Provide ends, and provide additional runners centered in all cabinets greater than 24 inches wide.
- B. Filler Strips: Provide as needed to close spaces between cabinets and walls, between cabinets and floors, ceilings, and indicated equipment. Fabricate from same material and with same finish as cabinets.
1. Provide top and bottom fillers and corner panels to close gaps and openings.

## 2.7 CASEWORK HARDWARE AND ACCESSORIES

- A. Hardware, General: Unless otherwise indicated, provide manufacturer's standard satin-finish, commercial-quality, heavy-duty hardware.
1. Use threaded metal or plastic inserts with machine screws for fastening to particleboard except where hardware is through-bolted from back side.
  2. Provide caps on fasteners at cabinet interiors in color to match adjacent cabinet finish color.
- B. Adjustable Shelf Supports: 2-pin locking plastic shelf rests complying with BHMA A156.9, Type B04013.
- C. Fastener Caps: Provide caps on fasteners at cabinet interiors in color to match adjacent cabinet finish color.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements, and other conditions affecting performance of manufactured wood casework.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 CASEWORK INSTALLATION

- A. General: Install cabinets to comply with same grade as item to be installed.
- B. Install level, plumb, and true; shim as required, using concealed shims. Where manufactured wood casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.
- C. Base Cabinets: Set cabinets straight, level, and plumb. Adjust subtops within 1/16 inch of a single plane. Fasten cabinets to masonry or framing, wood blocking, or reinforcements in walls and partitions with fasteners spaced 24 inches o.c. Bolt adjacent cabinets together with joints flush, tight, and uniform. Align similar adjoining doors and drawers to a tolerance of 1/16 inch.
  - 1. Where base cabinets are not installed adjacent to walls, fasten to floor at toe space with fasteners spaced 24 inches o.c. Secure sides of cabinets to floor, where they do not adjoin other cabinets, with not less than two fasteners.
- D. Fasten cabinets to adjacent cabinets and to masonry, framing, wood blocking, or reinforcements in walls and partitions to comply with the AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."
- E. Install hardware uniformly and precisely. Set hinges snug and flat in mortises unless otherwise indicated. Adjust and align hardware so moving parts operate freely and contact points meet accurately. Allow for final adjustment after installation.
- F. Adjust casework and hardware so doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

### 3.3 INSTALLATION OF SHELVING

- A. Securely fasten shelf standards to masonry, partition framing, wood blocking, or reinforcements in partitions.
  - 1. Fasten shelf standards at ends and not more than 12 inches ( ) o.c.
  - 2. Use toggle bolts at hollow masonry.
  - 3. Use expansion anchors at solid masonry.
  - 4. Use self-tapping sheet metal screws in metal framing or metal backing at metal-framed partitions. Do not use wall anchors in gypsum board.
  - 5. Use wood screws sized for 1-inch ( ) penetration into wood blocking.
  - 6. Use toggle bolts at plaster on metal lath.
- B. Install shelf standards plumb and at heights to align shelf brackets for level shelves. Space standards not more than 36 inches o.c.
- C. Install shelving level and straight, closely fitted to other work where indicated.

### 3.4 CLEANING AND PROTECTING

- A. Repair or remove and replace defective work as directed on completion of installation.
- B. Clean finished surfaces, touch up as required, and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.



- C. Protection: Provide 6-mil plastic or other suitable water-resistant covering over countertop surfaces. Tape to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

END OF SECTION 123200



## SECTION 211313 - WET-PIPE SPRINKLER SYSTEMS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Pipes, fittings, and specialties.
  - 2. Fire-protection valves.
  - 3. Fire-department connections.
  - 4. Sprinklers.
  - 5. Excess-pressure pumps.
  - 6. Alarm devices.
  - 7. Pressure gages.

#### 1.2 SYSTEM DESCRIPTIONS

- A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.
- B. Deluge Sprinkler System: Open sprinklers are attached to piping connected to water supply through deluge valve. Fire-detection system, in same area as sprinklers, opens valve. Water flows into piping system and discharges from attached sprinklers when valve opens.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- B. Delegated Design: Design sprinkler system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
  - 1. Engage utility for a flow test to confirm pressures and flows.
- C. Sprinkler system design shall be approved by authorities having jurisdiction.
  - 1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
  - 2. Sprinkler Occupancy Hazard Classifications:
    - a. Building Service Areas: Ordinary Hazard, Group 1.
    - b. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
    - c. General Storage Areas: Ordinary Hazard, Group 1.
    - d. Laundries: Ordinary Hazard, Group 1.
    - e. Libraries except Stack Areas: Light Hazard.
    - f. Library Stack Areas: Ordinary Hazard, Group 2.
    - g. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
    - h. Office and Public Areas: Light Hazard.
    - i. Repair Garages: Ordinary Hazard, Group 2.
    - j. Restaurant Service Areas: Ordinary Hazard, Group 1.
    - k. Solvent Cleaning Areas: Extra Hazard, Group 2.
  - 3. Minimum Density for Automatic-Sprinkler Piping Design:
    - a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
    - b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
    - c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.
    - d. Special Occupancy Hazard: As determined by authorities having jurisdiction.
  - 4. Maximum Protection Area per Sprinkler: Per UL listing.
  - 5. Maximum Protection Area per Sprinkler:
    - a. Office Spaces: 225 sq. ft.
    - b. Storage Areas: 130 sq. ft.
    - c. Mechanical Equipment Rooms: 130 sq. ft.
    - d. Electrical Equipment Rooms: 130 sq. ft.
    - e. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.
  - 6. Total Combined Hose-Stream Demand Requirement: According to NFPA 13.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For wet-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Wiring Diagrams: For power, signal, and control wiring.
- C. Delegated-Design Submittal: For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Qualification Data: For qualified Installer and professional engineer.
- E. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- F. Welding certificates.
- G. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
- H. Field quality-control reports.
- I. Operation and maintenance data.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
  - 1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
    - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
- B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.
- C. 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.
- D. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
  - 1. NFPA 13, "Installation of Sprinkler Systems."
  - 2. NFPA 13R, "Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height."
  - 3. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

### PART 2 - PRODUCTS

#### 2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

#### 2.2 STEEL PIPE AND FITTINGS

- A. Standard Weight, Galvanized- and Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

- B. Schedule 30, Galvanized- and Black-Steel Pipe: ASTM A 135; ASTM A 795/A 795M, Type E; or ASME B36.10M, wrought steel; with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.
- C. Thinwall Galvanized- and Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.
- D. Galvanized and Black Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.
- E. Galvanized and uncoated, Steel Couplings: ASTM A 865, threaded.
- F. Galvanized and uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- G. Malleable- or Ductile-Iron Unions: UL 860.
- H. Cast-Iron Flanges: ASME 16.1, Class 125.
- I. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
- J. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.
- K. Grooved-Joint, Steel-Pipe Appurtenances:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Anvil International, Inc.
    - b. Tyco Fire & Building Products LP.
    - c. Victaulic Company.
    - d. Pre-approved equal.
  - 2. Pressure Rating: 175 psig minimum.
  - 3. Galvanized and Uncoated, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
  - 4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

## 2.3 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free.
  - 1. Class 125, Cast-Iron Flat-Face Flanges: Full-face gaskets.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

## 2.4 LISTED FIRE-PROTECTION VALVES

- A. General Requirements:
  - 1. Valves shall be UL listed or FM approved.
  - 2. Minimum Pressure Rating: 175 psig.
- B. Check Valves:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Cast Iron Pipe Company; Waterous Company Subsidiary.
    - b. Anvil International, Inc.
    - c. Clow Valve Company; a division of McWane, Inc.
    - d. Crane Co.; Crane Valve Group; Crane Valves.
    - e. Crane Co.; Crane Valve Group; Jenkins Valves.
    - f. Crane Co.; Crane Valve Group; Stockham Division.
    - g. Fire-End & Croker Corporation.

- h. Fire Protection Products, Inc.
  - i. Globe Fire Sprinkler Corporation.
  - j. Kennedy Valve; a division of McWane, Inc.
  - k. Metraflex, Inc.
  - l. Milwaukee Valve Company.
  - m. Mueller Co.; Water Products Division.
  - n. NIBCO INC.
  - o. Potter Roemer.
  - p. Reliable Automatic Sprinkler Co., Inc.
  - q. Tyco Fire & Building Products LP.
  - r. United Brass Works, Inc.
  - s. Venus Fire Protection Ltd.
  - t. Victaulic Company.
  - u. Viking Corporation.
  - v. Watts Water Technologies, Inc.
  - w. Pre-approved equal.
- 2. Standard: UL 312.
  - 3. Pressure Rating: 250 psig minimum
  - 4. Type: Swing check.
  - 5. Body Material: Cast iron.
  - 6. End Connections: Flanged or grooved.
- C. Bronze OS&Y Gate Valves:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Crane Co.; Crane Valve Group; Stockham Division.
    - c. Milwaukee Valve Company.
    - d. NIBCO INC.
    - e. United Brass Works, Inc.
    - f. Pre-approved equal.
  - 2. Standard: UL 262.
  - 3. Pressure Rating: 175 psig.
  - 4. Body Material: Bronze.
  - 5. End Connections: Threaded.
- D. Iron OS&Y Gate Valves:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Cast Iron Pipe Company; Waterous Company Subsidiary.
    - b. American Valve, Inc.
    - c. Clow Valve Company; a division of McWane, Inc.
    - d. Crane Co.; Crane Valve Group; Crane Valves.
    - e. Crane Co.; Crane Valve Group; Jenkins Valves.
    - f. Crane Co.; Crane Valve Group; Stockham Division.
    - g. Hammond Valve.
    - h. Milwaukee Valve Company.
    - i. Mueller Co.; Water Products Division.
    - j. NIBCO INC.
    - k. Tyco Fire & Building Products LP.
    - l. United Brass Works, Inc.
    - m. Watts Water Technologies, Inc.
    - n. Pre-approved equal.
  - 2. Standard: UL 262.
  - 3. Pressure Rating: 250 psig minimum
  - 4. Body Material: Cast or ductile iron.
  - 5. End Connections: Flanged or grooved.
- E. Indicating-Type Butterfly Valves:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Anvil International, Inc.
    - b. Global Safety Products, Inc.
    - c. Kennedy Valve; a division of McWane, Inc.
    - d. Milwaukee Valve Company.
    - e. NIBCO INC.
    - f. Tyco Fire & Building Products LP.

- g. Victaulic Company.
  - h. Pre-approved equal.
- 2. Standard: UL 1091.
- 3. Pressure Rating: 175 psig minimum.
- 4. Valves NPS 2 and Smaller:
  - a. Valve Type: Ball or butterfly.
  - b. Body Material: Bronze.
  - c. End Connections: Threaded.
- 5. Valves NPS 2-1/2 and Larger:
  - a. Valve Type: Butterfly.
  - b. Body Material: Cast or ductile iron.
  - c. End Connections: Flanged, grooved, or wafer.
- 6. Valve Operation: Integral electrical, 115-V ac, prewired, single-circuit, supervisory switch or electrical, 115-V ac, prewired, two-circuit, supervisory switch and visual indicating device.

## 2.5 TRIM AND DRAIN VALVES

- A. General Requirements:
  - 1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
  - 2. Minimum Pressure Rating: 175 psig.
- B. Ball Valves:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Anvil International, Inc.
    - b. Conbraco Industries, Inc.; Apollo Valves.
    - c. Fire-End & Croker Corporation.
    - d. Fire Protection Products, Inc.
    - e. Flowserve.
    - f. Kennedy Valve; a division of McWane, Inc.
    - g. Milwaukee Valve Company.
    - h. NIBCO INC.
    - i. Potter Roemer.
    - j. Red-White Valve Corporation.
    - k. Tyco Fire & Building Products LP.
    - l. Victaulic Company.
    - m. Watts Water Technologies, Inc.
    - n. Pre-approved equal.

## 2.6 SPECIALTY VALVES

- A. General Requirements:
  - 1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
  - 2. Minimum Pressure Rating: 175 psig.
  - 3. Body Material: Cast or ductile iron.
  - 4. Size: Same as connected piping.
  - 5. End Connections: Flanged or grooved.
- B. Alarm Valves:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Globe Fire Sprinkler Corporation.
    - b. Reliable Automatic Sprinkler Co., Inc.
    - c. Tyco Fire & Building Products LP.
    - d. Victaulic Company.
    - e. Viking Corporation.
    - f. Pre-approved equal.
  - 2. Standard: UL 193.
  - 3. Design: For horizontal or vertical installation.
  - 4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
  - 5. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
  - 6. Drip Cup Assembly: Pipe drain with check valve to main drain piping.

- C. Automatic (Ball Drip) Drain Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. AFAC Inc.
    - b. Reliable Automatic Sprinkler Co., Inc.
    - c. Tyco Fire & Building Products LP.
    - d. Pre-approved equal.
  2. Standard: UL 1726.
  3. Pressure Rating: 175 psig minimum.
  4. Type: Automatic draining, ball check.
  5. Size: NPS 3/4.
  6. End Connections: Threaded.

## 2.7 SPRINKLER SPECIALTY PIPE FITTINGS

- A. Branch Outlet Fittings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Anvil International, Inc.
    - b. National Fittings, Inc.
    - c. Tyco Fire & Building Products LP.
    - d. Victaulic Company.
    - e. Pre-approved equal.
  2. Standard: UL 213.
  3. Pressure Rating: 175 psig minimum.
  4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
  5. Type: Mechanical-T and -cross fittings.
  6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
  7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
  8. Branch Outlets: Grooved, plain-end pipe, or threaded.
- B. Flow Detection and Test Assemblies:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Reliable Automatic Sprinkler Co., Inc.
    - b. Tyco Fire & Building Products LP.
    - c. Victaulic Company.
    - d. Pre-approved equal.
  2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
  3. Pressure Rating: 175 psig minimum.
  4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
  5. Size: Same as connected piping.
  6. Inlet and Outlet: Threaded.
- C. Branch Line Testers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Elkhart Brass Mfg. Company, Inc.
    - b. Fire-End & Croker Corporation.
    - c. Potter Roemer.
    - d. Pre-approved equal.
  2. Standard: UL 199.
  3. Pressure Rating: 175 psig minimum.
  4. Body Material: Brass.
  5. Size: Same as connected piping.
  6. Inlet: Threaded.
  7. Drain Outlet: Threaded and capped.
  8. Branch Outlet: Threaded, for sprinkler.
- D. Sprinkler Inspector's Test Fittings:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. AGF Manufacturing Inc.
    - b. Triple R Specialty.
    - c. Tyco Fire & Building Products LP.
    - d. Victaulic Company.



- e. Viking Corporation.
    - f. Pre-approved equal.
  - 2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
  - 3. Pressure Rating: 175 psig minimum.
  - 4. Body Material: Cast- or ductile-iron housing with sight glass.
  - 5. Size: Same as connected piping.
  - 6. Inlet and Outlet: Threaded.
- E. Adjustable Drop Nipples:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. CECA, LLC.
    - b. Corcoran Piping System Co.
    - c. Merit Manufacturing; a division of Anvil International, Inc.
    - d. Pre-approved equal.
  - 2. Standard: UL 1474.
  - 3. Pressure Rating: 250 psig minimum.
  - 4. Body Material: Steel pipe with EPDM-rubber O-ring seals.
  - 5. Size: Same as connected piping.
  - 6. Length: Adjustable.
  - 7. Inlet and Outlet: Threaded.
- F. Flexible, Sprinkler Hose Fittings:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Fivalco Inc.
    - b. FlexHead Industries, Inc.
    - c. Gateway Tubing, Inc.
    - d. Pre-approved equal.
  - 2. Standard: UL 1474.
  - 3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
  - 4. Pressure Rating: 175 psig minimum.
  - 5. Size: Same as connected piping, for sprinkler.

## 2.8 SPRINKLERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 1. Globe Fire Sprinkler Corporation.
  - 2. Reliable Automatic Sprinkler Co., Inc.
  - 3. Tyco Fire & Building Products LP.
  - 4. Venus Fire Protection Ltd.
  - 5. Victaulic Company.
  - 6. Viking Corporation.
  - 7. Pre-approved equal.
- B. General Requirements:
- 1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
  - 2. Pressure Rating for Residential Sprinklers: 175 psig maximum.
  - 3. Pressure Rating for Automatic Sprinklers: 175 psig minimum.
  - 4. Pressure Rating for High-Pressure Automatic Sprinklers: 250 psig minimum.
- C. Automatic Sprinklers with Heat-Responsive Element:
- 1. Early-Suppression, Fast-Response Applications: UL 1767.
  - 2. Nonresidential Applications: UL 199.
  - 3. Residential Applications: UL 1626.
  - 4. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
- D. Sprinkler Finishes:
- 1. Chrome plated.
  - 2. Bronze.
  - 3. Painted.

- E. Special Coatings:
  - 1. Wax.
  - 2. Lead.
  - 3. Corrosion-resistant paint.
- F. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
  - 1. Ceiling Mounting: Chrome-plated steel, two piece, with 1-inch vertical adjustment.
  - 2. Sidewall Mounting: Chrome-plated steel, one piece, flat.
- G. Sprinkler Guards:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Reliable Automatic Sprinkler Co., Inc.
    - b. Tyco Fire & Building Products LP.
    - c. Victaulic Company.
    - d. Viking Corporation.
    - e. Pre-approved equal.
  - 2. Standard: UL 199.
  - 3. Type: Wire cage with fastening device for attaching to sprinkler.

## 2.9 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
- B. Water-Motor-Operated Alarm:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Globe Fire Sprinkler Corporation.
    - b. Tyco Fire & Building Products LP.
    - c. Victaulic Company.
    - d. Viking Corporation.
    - e. Pre-approved equal.
  - 2. Standard: UL 753.
  - 3. Type: Mechanically operated, with Pelton wheel.
  - 4. Alarm Gong: Cast aluminum with red-enamel factory finish.
  - 5. Size: 10-inch diameter.
  - 6. Components: Shaft length, bearings, and sleeve to suit wall construction.
  - 7. Inlet: NPS 3/4.
  - 8. Outlet: NPS 1 drain connection.
- C. Water-Flow Indicators:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ADT Security Services, Inc.
    - b. McDonnell & Miller; ITT Industries.
    - c. Potter Electric Signal Company.
    - d. System Sensor; a Honeywell company.
    - e. Viking Corporation.
    - f. Watts Industries (Canada) Inc.
    - g. Pre-approved equal.
  - 2. Standard: UL 346.
  - 3. Water-Flow Detector: Electrically supervised.
  - 4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
  - 5. Type: Paddle operated.
  - 6. Pressure Rating: 250 psig.
  - 7. Design Installation: Horizontal or vertical.
- D. Valve Supervisory Switches:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Fire-Lite Alarms, Inc.; a Honeywell company.
    - b. Kennedy Valve; a division of McWane, Inc.
    - c. Potter Electric Signal Company.
    - d. System Sensor; a Honeywell company.

- e. Pre-approved equal.
- 2. Standard: UL 346.
- 3. Type: Electrically supervised.
- 4. Components: Single-pole, double-throw switch with normally closed contacts.
- 5. Design: Signals that controlled valve is in other than fully open position.

## 2.10 PRESSURE GAGES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AMETEK; U.S. Gauge Division.
  - 2. Ashcroft, Inc.
  - 3. Brecco Corporation.
  - 4. WIKA Instrument Corporation.
  - 5. Pre-approved equal.
- B. Standard: UL 393.
- C. Dial Size: 3-1/2- to 4-1/2-inch diameter.
- D. Pressure Gage Range: 0 to 250 psig minimum.
- E. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.
- F. Air System Piping Gage: Include retard feature and "AIR" or "AIR/WATER" label on dial face.

## 2.11 ESCUTCHEONS

- A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.
- B. One-Piece, Cast-Brass Escutcheons: Polished chrome-plated finish with set-screws.
- C. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with chrome-plated finish.
- D. One-Piece, Stamped-Steel Escutcheons: Chrome-plated finish with set-screw.
- E. Split-Casting, Cast-Brass Escutcheons: Polished chrome-plated finish with concealed hinge and set-screw.
- F. Split-Plate, Stamped-Steel Escutcheons: Chrome-plated finish with concealed hinge, set-screw.
- G. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- H. Split-Casting Floor Plates: Cast brass with concealed hinge.

## 2.12 SLEEVES

- A. Cast-Iron Wall Pipe Sleeves: Cast or fabricated of cast iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- C. Molded-PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- D. Molded-PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.
- E. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- F. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, standard weight, zinc coated, plain ends.

- G. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
  - 1. Underdeck Clamp: Clamping ring with set-screws.

## 2.13 SLEEVE SEALS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Advance Products & Systems, Inc.
  - 2. Calpico, Inc.
  - 3. Metraflex, Inc.
  - 4. Pipeline Seal and Insulator, Inc.
  - 5. Pre-approved equal.
- B. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
  - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 2. Pressure Plates: Carbon steel, plastic, or stainless steel.
  - 3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating or stainless steel of length required to secure pressure plates to sealing elements.

## 2.14 GROUT

- A. Standard: ASTM C 1107, Grade B, posthardening and volume adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink, and recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 SERVICE-ENTRANCE PIPING

- A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping in Division 21 Section "Facility Fire-Suppression Water-Service Piping."
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping.
- C. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

### 3.2 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
  - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
- B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.
- C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- D. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

- G. Install sprinkler piping with drains for complete system drainage.
- H. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- I. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.
- J. Install alarm devices in piping systems.
- K. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
- L. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- M. Fill sprinkler system piping with water.
- N. Install electric heating cables and pipe insulation on sprinkler piping in areas subject to freezing. Comply with requirements for heating cables in Division 21 "Heat Tracing for Fire-Suppression Piping" and for piping insulation in Division 21 Section "Fire-Suppression Systems Insulation."

### 3.3 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.
- I. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
- J. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
  - 1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.
- K. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

- L. Steel-Piping, Pressure-Sealed Joints: Join Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
- M. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

#### 3.4 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Specialty Valves:
  - 1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
  - 2. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.

#### 3.5 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.
- B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.
- C. Install sprinklers into flexible, sprinkler hose fittings and install hose into bracket on ceiling grid.

#### 3.6 ESCUTCHEON INSTALLATION

- A. Install escutcheons for penetrations of walls, ceilings, and floors.
- B. Escutcheons for New Piping:
  - 1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
  - 2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
  - 3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece or split casting, cast brass with polished chrome-plated finish.
  - 4. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish.
  - 5. Bare Piping in Equipment Rooms: One piece, cast brass or stamped steel with set-screw.
  - 6. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.

#### 3.7 SLEEVE INSTALLATION

- A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
- B. Sleeves are not required for core-drilled holes.
- C. Permanent sleeves are not required for holes formed by removable PE sleeves.
- D. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
- E. Install sleeves in new partitions, slabs, and walls as they are built.
- F. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants."

- G. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants."
- H. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals.
- I. Seal space outside of sleeves in concrete slabs and walls with grout.
- J. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.
- K. Install sleeve materials according to the following applications:
  - 1. Sleeves for Piping Passing through Concrete Floor Slabs: Galvanized-steel pipe.
  - 2. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Galvanized-steel pipe.
    - a. Extend sleeves 2 inches above finished floor level.
    - b. For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Comply with requirements for flashing in Division 07 Section "Sheet Metal Flashing and Trim."
  - 3. Sleeves for Piping Passing through Gypsum-Board Partitions:
    - a. Galvanized-steel-pipe sleeves for pipes smaller than NPS 6.
    - b. Galvanized-steel-sheet sleeves for pipes NPS 6 and larger.
    - c. Exception: Sleeves are not required for water-supply tubes and waste pipes for individual plumbing fixtures if escutcheons will cover openings.
  - 4. Sleeves for Piping Passing through Concrete Roof Slabs: Galvanized-steel pipe.
  - 5. Sleeves for Piping Passing through Exterior Concrete Walls:
    - a. Galvanized-steel-pipe sleeves for pipes smaller than NPS 6.
    - b. Cast-iron wall-pipe sleeves for pipes NPS 6 and larger.
    - c. Install sleeves that are large enough to provide 1-inch annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.
  - 6. Sleeves for Piping Passing through Interior Concrete Walls:
    - a. Galvanized-steel-pipe sleeves for pipes smaller than NPS 6.
    - b. Galvanized-steel-sheet sleeves for pipes NPS 6 and larger.
- L. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestop materials and installations in Division 07 Section "Penetration Firestopping."

### 3.8 SLEEVE SEAL INSTALLATION

- A. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.
- B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### 3.9 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

### 3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.

4. Energize circuits to electrical equipment and devices.
5. Start and run excess-pressure pumps.
6. Coordinate with fire-alarm tests. Operate as required.
7. Coordinate with fire-pump tests. Operate as required.
8. Verify that equipment hose threads are same as local fire-department equipment.

C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

### 3.11 CLEANING

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

### 3.12 PIPING SCHEDULE

A. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends; cast-iron threaded fittings; and threaded or grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

C. Wet-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:

1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.
3. Standard-weight, black-steel pipe with plain ends; uncoated, plain-end-pipe fittings; and twist-locked joints.
4. Standard-weight, galvanized-steel pipe with plain ends; galvanized, plain-end-pipe fittings; and twist-locked joints.
5. Standard-weight, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
6. Standard-weight, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
7. Standard-weight, black-steel pipe with plain ends; steel welding fittings; and welded joints.

D. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 6, shall be one of the following:

1. Standard-weight or Schedule 30, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
2. Standard-weight or Schedule 30, galvanized-steel pipe with cut-grooved ends; galvanized, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
3. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
4. Thinwall black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
5. Thinwall black-steel pipe with plain ends; welding fittings; and welded joints.

### 3.13 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. All Gypboard Ceilings and/or Soffits: Concealed head sprinklers - custom color by Architect.
2. Auditorium 'House' ceiling system: Concealed head sprinklers - custom color by Architect.
3. Locate sprinkler heads per detail on Drawings.
4. Stage: provide manufacturer provided cage around each sprinkler head.
5. Stage Craft: provide manufacturer provided cage around each sprinkler head.
6. Gyms: provide manufacturer provided cage around each sprinkler head.
7. Wrestling Room: provide manufacturer provided cage around each sprinkler head.
8. Weight Room: provide manufacturer provided cage around each sprinkler head.
9. Locker Rooms: provide manufacturer provided cage around each sprinkler head.
10. Rooms without Ceilings: Upright sprinklers.
11. Rooms with Suspended Ceilings: Pendent sprinklers.



12. Wall Mounting: Sidewall sprinklers.
13. Spaces Subject to Freezing: Pendent, dry sprinklers.
14. Deluge-Sprinkler Systems: pendent, open sprinklers.

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Concealed Sprinklers: Rough brass, with custom color plate.
2. Recessed Sprinklers: Bright chrome, with chrome escutcheon.
3. Upright, Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

**END OF SECTION 211313**



## **SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING**

### **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. Piping materials and installation instructions common to most piping systems.
  - 2. Transition fittings.
  - 3. Dielectric fittings.
  - 4. Mechanical sleeve seals.
  - 5. Sleeves.
  - 6. Escutcheons.
  - 7. Grout.
  - 8. Plumbing demolition.
  - 9. Equipment installation requirements common to equipment sections.
  - 10. Painting and finishing.
  - 11. Concrete bases.
  - 12. Supports and anchorages.

#### **1.3 DEFINITIONS**

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
  - 1. ABS: Acrylonitrile-butadiene-styrene plastic.
  - 2. CPVC: Chlorinated polyvinyl chloride plastic.
  - 3. PE: Polyethylene plastic.
  - 4. PVC: Polyvinyl chloride plastic.
- G. The following are industry abbreviations for rubber materials:
  - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
  - 2. NBR: Acrylonitrile-butadiene rubber.

#### **1.4 SUBMITTALS**

- A. Product Data: For the following:
  - 1. Transition fittings.
  - 2. Dielectric fittings.
  - 3. Mechanical sleeve seals.
  - 4. Escutcheons.

- B. Welding certificates.

## 1.5 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

## 1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

### 2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

### 2.3 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
  - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. Solvent Cements for Joining Plastic Piping:
  - 1. ABS Piping: ASTM D 2235.
  - 2. CPVC Piping: ASTM F 493.
  - 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
  - 4. PVC to ABS Piping Transition: ASTM D 3138.
- I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

## 2.4 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
  - 1. Manufacturers:
    - a. Cascade Waterworks Mfg. Co.
    - b. Dresser Industries, Inc.; DMD Div.
    - c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
    - d. JCM Industries.
    - e. Smith-Blair, Inc.
    - f. Viking Johnson.
  - 2. Underground Piping NPS 1-1/2 and Smaller: Manufactured fitting or coupling.
  - 3. Underground Piping NPS 2 and Larger: AWWA C219, metal sleeve-type coupling.
  - 4. Aboveground Pressure Piping: Pipe fitting.
- B. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
  - 1. Manufacturers:
    - a. Eslon Thermoplastics.
- C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
  - 1. Manufacturers:
    - a. Thompson Plastics, Inc.
- D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
  - 1. Manufacturers:
    - a. NIBCO INC.
    - b. NIBCO, Inc.; Chemtrol Div.
- E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.
  - 1. Manufacturers:
    - a. Cascade Waterworks Mfg. Co.
    - b. Fernco, Inc.
    - c. Mission Rubber Company.
    - d. Plastic Oddities, Inc.

## 2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
  - 1. Manufacturers:
    - a. Capitol Manufacturing Co.
    - b. Central Plastics Company.
    - c. Eclipse, Inc.
    - d. Epco Sales, Inc.
    - e. Hart Industries, International, Inc.
    - f. Watts Industries, Inc.; Water Products Div.
    - g. Zurn Industries, Inc.; Wilkins Div.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
  - 1. Manufacturers:
    - a. Capitol Manufacturing Co.
    - b. Central Plastics Company.
    - c. Epco Sales, Inc.
    - d. Watts Industries, Inc.; Water Products Div.
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
  - 1. Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Central Plastics Company.
    - d. Pipeline Seal and Insulator, Inc.
  - 2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
  - 1. Manufacturers:
    - a. Calpico, Inc.
    - b. Lochinvar Corp.
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.
  - 1. Manufacturers:
    - a. Perfection Corp.
    - b. Precision Plumbing Products, Inc.
    - c. Sioux Chief Manufacturing Co., Inc.
    - d. Victaulic Co. of America.

## 2.6 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
  - 1. Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.
  - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 3. Pressure Plates: Plastic, carbon steel, or stainless steel. Include two for each sealing element.
  - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating or stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.7 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
  - 1. Underdeck Clamp: Clamping ring with set screws.
- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe: ASTM D 1785, Schedule 40.
- G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

## 2.8 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
  - 1. Finish: Polished chrome-plated.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
  - 1. Finish: Polished chrome-plated.
- E. One-Piece, Stamped-Steel Type: With set screw and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw, and chrome-plated finish.
- G. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

## 2.9 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
  - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.
  - 3. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
  - 1. New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
    - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
    - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
    - g. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    - h. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
    - i. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
- M. Sleeves are not required for core-drilled holes.
- N. Permanent sleeves are not required for holes formed by removable PE sleeves.
- O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- P. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
  - 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
    - a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
    - b. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
      - 1) Seal space outside of sleeve fittings with grout.
  - 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- Q. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- R. Verify final equipment locations for roughing-in.
- S. Coordinate location of vents through roof with rooftop mounted air units fresh air intakes.



- T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### 3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
  3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
  4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
  5. PVC Nonpressure Piping: Join according to ASTM D 2855.
  6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
1. Plain-End Pipe and Fittings: Use butt fusion.
  2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

### 3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping NPS 2 and smaller, at final connection to each piece of equipment.
  2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
  3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
  4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

5. Install shutoff valves on all equipment and piping branch lines that serve more than four pieces of equipment.

#### 3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.
- E. Install floor drains for all equipment requiring condensate or indirect waste removal. Coordinate requirements with HVAC contractor and with Owner-furnished equipment.

#### 3.5 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

#### 3.6 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

**END OF SECTION 220500**

## **SECTION 220516 - EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING**

### **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. Flexible-hose packless expansion joints.
  - 2. Metal-bellows packless expansion joints.
  - 3. Rubber packless expansion joints.
  - 4. Grooved-joint expansion joints.
  - 5. Pipe loops and swing connections.
  - 6. Alignment guides and anchors.

#### **1.3 PERFORMANCE REQUIREMENTS**

- A. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.
- B. Capability: Products to absorb 200 percent of maximum axial movement between anchors.

#### **1.4 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Delegated-Design Submittal: For each anchor and alignment guide 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. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and swing connections.
  - 2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
  - 3. Alignment Guide Details: Detail field assembly and attachment to building structure.
  - 4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.
- C. Welding certificates.
- D. Product Certificates: For each type of expansion joint, from manufacturer.
- E. Maintenance Data: For expansion joints to include in maintenance manuals.

#### **1.5 QUALITY ASSURANCE**

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - 2. ASME Boiler and Pressure Vessel Code: Section IX.

### **PART 2 - PRODUCTS**

#### **2.1 PACKLESS EXPANSION JOINTS**

- A. Flexible-Hose Packless Expansion Joints:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Flex-Hose Co., Inc.
    - b. Flexicraft Industries.

- c. Flex Pression Ltd.
  - d. Metraflex, Inc.
  - e. Unisource Manufacturing, Inc.
  - f. Pre-approved equal.
2. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose.
  3. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.
  4. Expansion Joints for Copper Tubing NPS 2 and Smaller: Copper-alloy fittings with solder-joint end connections.
    - a. Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F and 340 psig at 450 deg F ratings.
    - b. Bronze hoses and double-braid bronze sheaths with 700 psig at 70 deg F and 500 psig at 450 deg F ratings.
  5. Expansion Joints for Copper Tubing NPS 2-1/2 to NPS 4: Copper-alloy fittings with threaded end connections.
    - a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F and 225 psig at 450 deg F ratings.
    - b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 420 psig at 70 deg F and 315 psig at 450 deg F ratings.
  6. Expansion Joints for Steel Piping NPS 2 and Smaller: Stainless-steel fittings with threaded end connections.
    - a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 450 psig at 70 deg F and 325 psig at 600 deg F (2250 kPa at 315 deg C) ratings.
    - b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 700 psig at 70 deg F and 515 psig at 600 deg F ratings.
  7. Expansion Joints for Steel Piping NPS 2-1/2 to NPS 6: Stainless-steel fittings with flanged end connections.
    - a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 200 psig at 70 deg F and 145 psig at 600 deg F ratings.
    - b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 275 psig at 70 deg F and 200 psig at 600 deg F ratings.
  8. Expansion Joints for Steel Piping NPS 8 to NPS 12: Stainless-steel fittings with flanged end connections.
    - a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 125 psig at 70 deg F and 90 psig at 600 deg F ratings.
    - b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 165 psig at 70 deg F and 120 psig at 600 deg F ratings.
- B. Metal-Bellows Packless Expansion Joints:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Adasco Manufacturing LLC.
    - b. American BOA, Inc.
    - c. Badger Industries, Inc.
    - d. Expansion Joint Systems, Inc.
    - e. Flex-Hose Co., Inc.
    - f. Flexicraft Industries.
    - g. Flex Pression Ltd.
    - h. Flex-Weld, Inc.
    - i. Flo Fab inc.
    - j. Hyspan Precision Products, Inc.
    - k. Metraflex, Inc.
    - l. Proco Products, Inc.
    - m. Senior Flexonics Pathway.
    - n. Tozen Corporation.
    - o. Unaflex.
    - p. Unisource Manufacturing, Inc.
    - q. Universal Metal Hose; a subsidiary of Hyspan Precision Products, Inc.
    - r. U.S. Bellows, Inc.
    - s. WahlcoMetroflex.
    - t. Pre-approved equal.
  2. Standards: ASTM F 1120 and EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."
  3. Type: Circular, corrugated bellows with external tie rods.
  4. Minimum Pressure Rating: 150 psig unless otherwise indicated.
  5. Configuration: Single joint with base and double joint with base class(es) unless otherwise indicated.
  6. Expansion Joints for Copper Tubing: Single- or multi-ply phosphor-bronze bellows, copper pipe ends, and brass shrouds.

- a. End Connections for Copper Tubing NPS 2 and Smaller: Solder joint.
  - b. End Connections for Copper Tubing NPS 2-1/2 to NPS 4: Solder joint.
  - c. End Connections for Copper Tubing NPS 5 and Larger: Flanged.
- C. Rubber Packless Expansion Joints:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Amber/Booth Company, Inc.; a div. of Vibration Isolation Products of Texas, Inc.
    - b. Mason Industries, Inc.; Mercer Rubber Co.
    - c. Metraflex, Inc.
    - d. Pre-approved equal.
  - 2. Standards: ASTM F 1123 and FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."
  - 3. Material: Fabric-reinforced rubber complying with FSA-NMEJ-703.
  - 4. Arch Type: multiple arches with external control rods.
  - 5. Spherical Type: multiple spheres with external control rods.
  - 6. Minimum Pressure Rating for NPS 1-1/2 to NPS 4: 150 psig at 220 deg F.
  - 7. Minimum Pressure Rating for NPS 5 and NPS 6: 140 psig at 200 deg F.
  - 8. Minimum Pressure Rating for NPS 8 to NPS 12: 140 psig at 180 deg F.
  - 9. Material for Water: EPDM.
  - 10. End Connections: Full-faced, integral steel flanges with steel retaining rings.

## 2.2 ALIGNMENT GUIDES AND ANCHORS

- A. Alignment Guides:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Adasco Manufacturing LLC.
    - b. Advanced Thermal Systems, Inc.
    - c. Flex-Hose Co., Inc.
    - d. Flexicraft Industries.
    - e. Flex-Weld, Inc.
    - f. Hyspan Precision Products, Inc.
    - g. Metraflex, Inc.
    - h. Senior Flexonics Pathway.
    - i. Unisource Manufacturing, Inc.
    - j. U.S. Bellows, Inc.
    - k. Pre-approved equal.
  - 2. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding spider for bolting to pipe.
- B. Anchor Materials:
- 1. Steel Shapes and Plates: ASTM A 36/A 36M.
  - 2. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.
  - 3. Washers: ASTM F 844, steel, plain, flat washers.
  - 4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.
    - a. Stud: Threaded, zinc-coated carbon steel.
    - b. Expansion Plug: Zinc-coated steel.
    - c. Washer and Nut: Zinc-coated steel.
  - 5. Chemical Fasteners: Insert-type-stud, bonding-system anchor for use with hardened portland cement concrete, with tension and shear capacities appropriate for application.
    - a. Bonding Material: ASTM C 881/C 881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
    - b. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud unless otherwise indicated.
    - c. Washer and Nut: Zinc-coated steel.

## PART 3 - EXECUTION

### 3.1 EXPANSION-JOINT INSTALLATION

- A. Install expansion joints of sizes matching sizes of piping in which they are installed.

- B. Install metal-bellows expansion joints according to EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."
- C. Install rubber packless expansion joints according to FSA-NMEJ-702.
- D. Install grooved-joint expansion joints to grooved-end steel piping

### 3.2 PIPE LOOP AND SWING CONNECTION INSTALLATION

- A. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.
- B. Connect risers and branch connections to mains with at least five pipe fittings including tee in main.
- C. Connect risers and branch connections to terminal units with at least four pipe fittings including tee in riser.
- D. Connect mains and branch connections to terminal units with at least four pipe fittings including tee in main.

### 3.3 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION

- A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.
- B. Install one or two guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.
- C. Attach guides to pipe and secure guides to building structure.
- D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
- E. Anchor Attachments:
  - 1. Anchor Attachment to Black-Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  - 2. Anchor Attachment to Galvanized-Steel Pipe: Attach with pipe hangers. Use MSS SP-69, Type 42, riser clamp welded to anchor.
  - 3. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24, U-bolts bolted to anchor.
- F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.
  - 1. Anchor Attachment to Steel Structural Members: Attach by welding.
  - 2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.
- G. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

**END OF SECTION 220516**

## **SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING**

### **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. Sleeves.
  - 2. Sleeve-seal systems.
  - 3. Sleeve-seal fittings.
  - 4. Grout.
- B. Related Requirements:
  - 1. Division 07 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

#### **1.3 ACTION SUBMITTALS**

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

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Field quality-control reports.

### **PART 2 - PRODUCTS**

#### **2.1 SLEEVES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Advance Products & Systems, Inc
  - 2. CALPICO, Inc
  - 3. GPT; an EnPro Industries company
- B. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop collar.
- C. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, anticorrosion coated or galvanized, with plain ends and integral welded waterstop collar.
- D. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

#### **2.2 SLEEVE-SEAL SYSTEMS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Advance Products & Systems, Inc
  - 2. CALPICO, Inc
  - 3. GPT; an EnPro Industries company
  - 4. Metraflex Company (The)
  - 5. Proco Products, Inc
- B. Description:
  - 1. Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
  - 2. Designed to form a hydrostatic seal of 20 psig minimum.

3. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
4. Pressure Plates: Carbon steel.
5. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, ASTM B 633 of length required to secure pressure plates to sealing elements.

## 2.3 SLEEVE-SEAL FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Advance Products & Systems, Inc
  2. CALPICO, Inc
  3. GPT; an EnPro Industries company
  4. Metraflex Company (The)
  5. Proco Products, Inc
- B. Description:
  1. Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.
  2. Plastic or rubber waterstop collar with center opening to match piping OD.

## 2.4 GROUT

- A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. Fasten sleeves securely in floors and walls so that they will not become displaced when concrete is poured or when other construction is built around them. Take precautions to prevent concrete, plaster or other materials from being forced into space between pipe and sleeve during construction
- C. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
  1. Sleeves are not required for core-drilled holes.
- D. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
  2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- E. Install sleeves for pipes passing through interior partitions.
  1. Cut sleeves to length for mounting flush with both surfaces.
  2. Install sleeves that are large enough to provide minimum 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.
- F. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 078413 "Penetration Firestopping."



### 3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

### 3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Use grout to seal the space around outside of sleeve-seal fittings.

### 3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
- B. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

### 3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  - 1. Exterior Concrete Walls above Grade:
    - a. Piping Smaller Than NPS 6: Steel pipe sleeves or sleeve-seal fittings.
    - b. Piping NPS 6 and Larger: Steel pipe sleeves or sleeve-seal fittings.
  - 2. Exterior Concrete Walls below Grade:
    - a. Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system, or sleeve-seal fittings.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
    - b. Piping NPS 6 and Larger: Steel pipe sleeves with sleeve-seal system, or sleeve-seal fittings.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
  - 3. Concrete Slabs-on-Grade:
    - a. Piping Smaller Than NPS 6: Steel pipe sleeves with sleeve-seal system, or sleeve-seal fittings.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
    - b. Piping NPS 6 and Larger: Steel pipe sleeves with sleeve-seal system, or sleeve-seal fittings.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
  - 4. Concrete Slabs above Grade:
    - a. Piping Smaller Than NPS 6: Steel pipe sleeves or sleeve-seal fittings.
    - b. Piping NPS 6 and Larger: Steel pipe sleeves.
  - 5. Interior Partitions:
    - a. Piping Smaller Than NPS 6: Steel pipe sleeves.
    - b. Piping NPS 6 and Larger: Galvanized-steel sheet sleeves.

**END OF SECTION 220517**



## **SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING**

### **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. Escutcheons.
  - 2. Floor plates.

#### **1.3 DEFINITIONS**

- A. Existing Piping to Remain: Existing piping that is not to be removed and that is not otherwise indicated to be removed and salvaged, or removed and reinstalled.

#### **1.4 ACTION SUBMITTALS**

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

### **PART 2 - PRODUCTS**

#### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. BrassCraft Manufacturing Co.; a Masco company
  - 2. Dearborn Brass
  - 3. Keeney Manufacturing Company (The)
  - 4. Mid-America Fittings, Inc.
  - 5. ProFlo; a Ferguson Enterprises, Inc. brand

#### **2.2 ESCUTCHEONS**

- A. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.
- B. One-Piece, Stainless-Steel Type: With polished stainless-steel finish.
- C. One-Piece, Cast-Brass Type: With polished, chrome-plated finish and setscrew fastener.
- D. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel or brass with polished, chrome-plated finish and spring-clip fasteners.
- E. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.
- F. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed hinge; and spring-clip fasteners.

#### **2.3 FLOOR PLATES**

- A. Split Floor Plates: Steel with concealed hinge.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Install escutcheons for exposed piping penetrations of finished walls, ceilings, and floors.

- B. Install escutcheons on bare piping to be compatible with pipe material:
  - 1. Copper Piping: Brass
  - 2. Ferrous Piping: Steel.
  - 3. Plastic Piping: Steel.
  - 4. Stainless Steel Piping: Stainless Steel.
  
- C. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
  - 1. Escutcheons for New Piping and Relocated Existing Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep pattern.
    - b. Chrome-Plated Piping: One-piece or split-plate, with concealed hinge with polished, chrome-plated finish.
    - c. Insulated Piping: One-piece or split-plate with concealed hinge with polished, chrome-plated finish.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece or split-plate with concealed hinge with polished, chrome-plated finish.
    - e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-plate with concealed hinge with polished, chrome-plated finish.
    - f. Bare Piping in Unfinished Service Spaces: One-piece or split-plate with concealed hinge with polished, chrome-plated finish.
    - g. Bare Piping in Equipment Rooms: One-piece or split-plate with concealed hinge with polished, chrome-plated finish.
  - 2. Escutcheons for Existing Piping to Remain:
    - a. Chrome-Plated Piping: Split-plate with concealed hinge with polished, chrome-plated finish.
    - b. Insulated Piping: Split-plate, stamped steel with concealed hinge with polished, chrome-plated finish.
    - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate with concealed hinge with polished, chrome-plated finish.
    - d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate with concealed hinge with polished, chrome-plated finish.
    - e. Bare Piping in Unfinished Service Spaces: Split-plate with concealed hinge with polished, chrome-plated finish.
    - f. Bare Piping in Equipment Rooms: Split-plate with concealed hinge with polished, chrome-plated finish.
  
- D. Install floor plates for exposed piping penetrations of floors in finished areas with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
  - 1. New Piping and Relocated Existing Piping: One-piece, floor plate.
  - 2. Existing Piping: Split floor plate.

### 3.2 FIELD QUALITY CONTROL

- A. Using new materials, replace broken and damaged escutcheons and floor plates.

### END OF SECTION 220518

## **SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING**

### **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. Bronze angle valves.
  - 2. Bronze ball valves.
  - 3. Iron, single-flange butterfly valves.
  - 4. Iron, grooved-end butterfly valves.
  - 5. Bronze swing check valves.
  - 6. Iron swing check valves.
  - 7. Iron swing check valves with closure control.
  - 8. Iron, grooved-end swing check valves.
  - 9. Iron, center-guided check valves.
  - 10. Bronze gate valves.
  - 11. Bronze globe valves.
  - 12. Iron globe valves.
  - 13. Polypropylene valves.
- B. Related Sections:
  - 1. Division 22 plumbing piping Sections for specialty valves applicable to those Sections only.
  - 2. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
  - 3. Division 33 water distribution piping Sections for general-duty and specialty valves for site construction piping.

#### **1.3 DEFINITIONS**

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.

#### **1.4 SUBMITTALS**

- A. Product Data: For each type of valve indicated.

#### **1.5 QUALITY ASSURANCE**

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
  - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  - 2. ASME B31.1 for power piping valves.
  - 3. ASME B31.9 for building services piping valves.

- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, grooves, and weld ends.
  - 3. Set angle, gate, and globe valves closed to prevent rattling.
  - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
  - 5. Set butterfly valves closed or slightly open.
  - 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
  - 1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
  - 2. Handwheel: For valves other than quarter-turn types.
  - 3. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.
  - 4. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug-valve head.
  - 5. 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.
- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
  - 1. Gate Valves: With rising stem.
  - 2. Ball Valves: With 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: With extended neck.
- F. Valve-End Connections:
  - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
  - 2. Grooved: With grooves according to AWWA C606.
  - 3. Solder Joint: With sockets according to ASME B16.18.
  - 4. Threaded: With threads according to ASME B1.20.1.
- G. Valve Bypass and Drain Connections: MSS SP-45.

### 2.2 BRONZE ANGLE VALVES

- A. Class 125, Bronze Angle Valves with Nonmetallic Disc:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Valve, Inc.
    - b. NIBCO INC.
  - 2. Description:
    - a. Standard: MSS SP-80, Type 2.

- b. CWP Rating: 200 psig.
- c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
- d. Ends: Threaded.
- e. Stem: Bronze.
- f. Disc: PTFE or TFE.
- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron, bronze, or aluminum.

## 2.3 BRONZE BALL VALVES

- A. One-Piece, Reduced-Port, Bronze Ball Valves with Bronze Trim:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Valve, Inc.
    - b. Conbraco Industries, Inc.; Apollo Valves.
    - c. NIBCO INC.
  - 2. Description:
    - a. Standard: MSS SP-110.
    - b. CWP Rating: 400 psig.
    - c. Body Design: One piece.
    - d. Body Material: Bronze.
    - e. Ends: Threaded.
    - f. Seats: PTFE or TFE.
    - g. Stem: Bronze.
    - h. Ball: Chrome-plated brass.
    - i. Port: Reduced.

## 2.4 IRON, SINGLE-FLANGE BUTTERFLY VALVES

- A. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ABZ Valve and Controls; a division of ABZ Manufacturing, Inc.
    - b. Conbraco Industries, Inc.; Apollo Valves.
    - c. Cooper Cameron Valves; a division of Cooper Cameron Corporation.
    - d. Crane Co.; Crane Valve Group; Jenkins Valves.
    - e. Crane Co.; Crane Valve Group; Stockham Division.
    - f. DeZurik Water Controls.
    - g. Flo Fab Inc.
    - h. Hammond Valve.
    - i. Kitz Corporation.
    - j. Legend Valve.
    - k. Milwaukee Valve Company.
    - l. NIBCO INC.
    - m. Norriseal; a Dover Corporation company.
    - n. Red-White Valve Corporation.
    - o. Spence Strainers International; a division of CIRCOR International, Inc.
    - p. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - 2. Description:
    - a. Standard: MSS SP-67, Type I.
    - b. CWP Rating: 200 psig.
    - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
    - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
    - e. Seat: EPDM.
    - f. Stem: One- or two-piece stainless steel.
    - g. Disc: Aluminum bronze.

## 2.5 IRON, GROOVED-END BUTTERFLY VALVES

- A. 175 CWP, Iron, Grooved-End Butterfly Valves:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Kennedy Valve; a division of McWane, Inc.
    - b. Shurjoint Piping Products.
    - c. Tyco Fire Products LP; Grinnell Mechanical Products.

- d. Victaulic Company.
- 2. Description:
  - a. Standard: MSS SP-67, Type I.
  - b. CWP Rating: 175 psig.
  - c. Body Material: Coated, ductile iron.
  - d. Stem: Two-piece stainless steel.
  - e. Disc: Coated, ductile iron.
  - f. Seal: EPDM.

## 2.6 BRONZE SWING CHECK VALVES

- A. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Crane Co.; Crane Valve Group; Jenkins Valves.
    - c. Crane Co.; Crane Valve Group; Stockham Division.
    - d. Hammond Valve.
    - e. Kitz Corporation.
    - f. Milwaukee Valve Company.
    - g. NIBCO INC.
    - h. Red-White Valve Corporation.
    - i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - 2. Description:
    - a. Standard: MSS SP-80, Type 4.
    - b. CWP Rating: 200 psig.
    - c. Body Design: Horizontal flow.
    - d. Body Material: ASTM B 62, bronze.
    - e. Ends: Threaded.
    - f. Disc: PTFE or TFE.

## 2.7 IRON SWING CHECK VALVES

- A. Class 125, Iron Swing Check Valves with Nonmetallic-to-Metal Seats:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Crane Co.; Crane Valve Group; Stockham Division.
  - 2. Description:
    - a. Standard: MSS SP-71, Type I.
    - b. CWP Rating: 200 psig.
    - c. Body Design: Clear or full waterway.
    - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
    - e. Ends: Flanged.
    - f. Trim: Composition.
    - g. Seat Ring: Bronze.
    - h. Disc Holder: Bronze.
    - i. Disc: PTFE or TFE.
    - j. Gasket: Asbestos free.

## 2.8 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

- A. Class 125, Iron Swing Check Valves with Lever- and Spring-Closure Control:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. NIBCO INC.
  - 2. Description:
    - a. Standard: MSS SP-71, Type I.
    - b. CWP Rating: 200 psig.
    - c. Body Design: Clear or full waterway.
    - d. Body Material: ASTM A 126, gray iron with bolted bonnet.
    - e. Ends: Flanged.
    - f. Trim: Bronze.
    - g. Gasket: Asbestos free.
    - h. Closure Control: Factory-installed, exterior lever and spring.



## 2.9 IRON, CENTER-GUIDED CHECK VALVES

- A. Class 125, Iron, Globe, Center-Guided Check Valves with Resilient Seat:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Anvil International, Inc.
    - b. APCO Willamette Valve and Primer Corporation.
    - c. Crispin Valve.
    - d. DFT Inc.
    - e. GA Industries, Inc.
    - f. Hammond Valve.
    - g. Milwaukee Valve Company.
    - h. NIBCO INC.
    - i. Sure Flow Equipment Inc.
    - j. Val-Matic Valve & Manufacturing Corp.
  2. Description:
    - a. Standard: MSS SP-125.
    - b. CWP Rating: 200 psig.
    - c. Body Material: ASTM A 126, gray iron.
    - d. Style: Globe, spring loaded.
    - e. Ends: Flanged.
    - f. Seat: EPDM.

## 2.10 BRONZE GATE VALVES

- A. Class 125, RS Bronze Gate Valves:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Valve, Inc.
    - b. Crane Co.; Crane Valve Group; Crane Valves.
    - c. Crane Co.; Crane Valve Group; Jenkins Valves.
    - d. Crane Co.; Crane Valve Group; Stockham Division.
    - e. Hammond Valve.
    - f. Kitz Corporation.
    - g. Milwaukee Valve Company.
    - h. NIBCO INC.
    - i. Powell Valves.
    - j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    - k. Zy-Tech Global Industries, Inc.
  2. Description:
    - a. Standard: MSS SP-80, Type 2.
    - b. CWP Rating: 200 psig.
    - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
    - d. Ends: Threaded or solder joint.
    - e. Stem: Bronze.
    - f. Disc: Solid wedge; bronze.
    - g. Packing: Asbestos free.
    - h. Handwheel: Malleable iron, bronze, or aluminum.

## 2.11 BRONZE GLOBE VALVES

- A. Class 125, Bronze Globe Valves with Nonmetallic Disc:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Crane Co.; Crane Valve Group; Stockham Division.
    - c. NIBCO INC.
    - d. Red-White Valve Corporation.
  2. Description:
    - a. Standard: MSS SP-80, Type 2.
    - b. CWP Rating: 200 psig.
    - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
    - d. Ends: Threaded or solder joint.
    - e. Stem: Bronze.
    - f. Disc: PTFE or TFE.
    - g. Packing: Asbestos free.

- h. Handwheel: Malleable iron, bronze, or aluminum.

## 2.12 IRON GLOBE VALVES

- A. Class 125, Iron Globe Valves:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Crane Co.; Crane Valve Group; Jenkins Valves.
    - c. Crane Co.; Crane Valve Group; Stockham Division.
    - d. Hammond Valve.
    - e. Kitz Corporation.
    - f. Milwaukee Valve Company.
    - g. NIBCO INC.
    - h. Powell Valves.
    - i. Red-White Valve Corporation.
    - j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    - k. Zy-Tech Global Industries, Inc.
  - 2. Description:
    - a. Standard: MSS SP-85, Type I.
    - b. CWP Rating: 200 psig.
    - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
    - d. Ends: Flanged.
    - e. Trim: Bronze.
    - f. Packing and Gasket: Asbestos free.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

### 3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install check valves for proper direction of flow and as follows:
  - 1. Swing Check Valves: In horizontal position with hinge pin level.

### 3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

### 3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
  - 1. Shutoff Service: Ball, butterfly, or gate valves.
  - 2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
  - 3. Throttling Service: Globe, ball, or butterfly valves.
  - 4. Pump-Discharge Check Valves:
    - a. NPS 2 and Smaller: Bronze swing check valves with nonmetallic disc.
    - b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring or iron, center-guided, resilient-seat check valves.
    - c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
  - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
  - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
  - 3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
  - 4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
  - 5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
  - 6. For Steel Piping, NPS 5 and Larger: Flanged ends.
  - 7. For Grooved-End Copper Tubing and Steel Piping: Valve ends may be grooved.

### 3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
  - 1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends. Solder joint ball valves allowed up to NPS 3.
  - 2. Bronze Angle Valves: Class 125, nonmetallic disc.
  - 3. Ball Valves: One piece, reduced port, bronze with bronze trim.
  - 4. Bronze Swing Check Valves: Class 125, nonmetallic disc.
  - 5. Bronze Gate Valves: Class 125, RS.
  - 6. Bronze Globe Valves: Class 125, nonmetallic disc.
- B. Pipe NPS 2-1/2 and Larger:
  - 1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
  - 2. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM seat, aluminum-bronze disc.
  - 3. Iron, Grooved-End Butterfly Valves: 175 CWP.
  - 4. Iron Swing Check Valves: Class 125, nonmetallic-to-metal seats.
  - 5. Iron Swing Check Valves with Closure Control: Class 125, lever and spring.
  - 6. Iron, Grooved-End Swing Check Valves: 300 CWP.
  - 7. Iron, Center-Guided Check Valves: Class 125, resilient seat.
  - 8. Iron Globe Valves: Class 125.

### END OF SECTION 220523



## **SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**

### **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 hangers and supports for plumbing system piping and equipment:
  - 1. Steel pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Fiberglass pipe hangers.
  - 4. Metal framing systems.
  - 5. Fiberglass strut systems.
  - 6. Thermal-hanger shield inserts.
  - 7. Fastener systems.
  - 8. Pipe stands.
  - 9. Pipe positioning systems.
  - 10. Equipment supports.
- B. Related Sections include the following:
  - 1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
  - 2. Division 21 Section "Water-Based Fire-Suppression Systems" for pipe hangers for fire-suppression piping.
  - 3. Division 22 Section "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
  - 4. Division 22 Section "Vibration for Plumbing Piping and Equipment" for vibration isolation devices.

#### **1.3 DEFINITIONS**

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

#### **1.4 PERFORMANCE REQUIREMENTS**

- A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

#### **1.5 SUBMITTALS**

- A. Product Data: For the following:
  - 1. Steel pipe hangers and supports.
  - 2. Fiberglass pipe hangers.
  - 3. Thermal-hanger shield inserts.
  - 4. Powder-actuated fastener systems.
  - 5. Pipe positioning systems.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:
  - 1. Trapeze pipe hangers. Include Product Data for components.
  - 2. Metal framing systems. Include Product Data for components.
  - 3. Fiberglass strut systems. Include Product Data for components.
  - 4. Pipe stands. Include Product Data for components.
  - 5. Equipment supports.

- C. Welding certificates.

## 1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code—Steel;" AWS D1.4, "Structural Welding Code—Reinforcing Steel;" and ASME Boiler and Pressure Vessel Code: Section IX.
- B. Welding: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1, "Structural Welding Code—Steel."
  - 2. AWS D1.2, "Structural Welding Code—Aluminum."
  - 3. AWS D1.4, "Structural Welding Code—Reinforcing Steel."
  - 4. ASME Boiler and Pressure Vessel Code: Section IX.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AAA Technology & Specialties Co., Inc.
  - 2. Bergen-Power Pipe Supports.
  - 3. B-Line Systems, Inc.; a division of Cooper Industries.
  - 4. Carpenter & Paterson, Inc.
  - 5. Empire Industries, Inc.
  - 6. ERICO/Michigan Hanger Co.
  - 7. Globe Pipe Hanger Products, Inc.
  - 8. Grinnell Corp.
  - 9. GS Metals Corp.
  - 10. National Pipe Hanger Corporation.
  - 11. PHD Manufacturing, Inc.
  - 12. PHS Industries, Inc.
  - 13. Piping Technology & Products, Inc.
  - 14. Tolco Inc.
  - 15. Pre-approved equal.
- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

### 2.3 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

### 2.4 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. B-Line Systems, Inc.; a division of Cooper Industries.

2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. GS Metals Corp.
4. Power-Strut Div.; Tyco International, Ltd.
5. Thomas & Betts Corporation.
6. Tolco Inc.
7. Unistrut Corp.; Tyco International, Ltd.
8. Pre-approved equal.

C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

## 2.5 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig-minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carpenter & Paterson, Inc.
2. ERICO/Michigan Hanger Co.
3. PHS Industries, Inc.
4. Pipe Shields, Inc.
5. Rilco Manufacturing Company, Inc.
6. Value Engineered Products, Inc.
7. Pre-approved equal.

C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.

E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

## 2.6 FASTENER SYSTEMS

A. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated or stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. B-Line Systems, Inc.; a division of Cooper Industries.
  - b. Empire Industries, Inc.
  - c. Hilti, Inc.
  - d. ITW Ramset/Red Head.
  - e. MKT Fastening, LLC.
  - f. Powers Fasteners.
  - g. Pre-approved equal.

## 2.7 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

## 2.8 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.

2. Design Mix: 5000-psi, 28-day compressive strength.

## PART 3 - EXECUTION

### 3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
  2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
  3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
  4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
  5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
  6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
  7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
  8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
  9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
  10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
  11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
  12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
  13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
  15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
  16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
  17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
  18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
  19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
  20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
  21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.



- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
  3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb.
    - b. Medium (MSS Type 32): 1500 lb.
    - c. Heavy (MSS Type 33): 3000 lb.
  13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
  15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
  2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
  3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
  4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
  5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
  6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
  7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.

8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
  - a. Horizontal (MSS Type 54): Mounted horizontally.
  - b. Vertical (MSS Type 55): Mounted vertically.
  - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- N. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.
- O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

### 3.2 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
  1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
  2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Fastener System Installation:
  1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Pipe Stand Installation:
  1. Pipe Stand Types except Curb-Mounting Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
  2. Curb-Mounting-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. Refer to Division 07 Section "Roof Accessories" for curbs.
- F. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Section "Plumbing Fixtures" for plumbing fixtures.
- G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- I. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- J. Install lateral bracing with pipe hangers and supports to prevent swaying.
- K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

- L. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.
- N. Insulated Piping: Comply with the following:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
  - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 4. Shield Dimensions for Pipe: Not less than the following:
    - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    - b. NPS 4: 12 inches long and 0.06 inch thick.
    - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
  - 5. Pipes NPS 8 and Larger: Include wood inserts.
  - 6. Insert Material: Length at least as long as protective shield.
  - 7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and 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. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

### 3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

### 3.6 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

**END OF SECTION 220529**

## **SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT**

### **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. Equipment labels.
  - 2. Warning signs and labels.
  - 3. Pipe labels.
  - 4. Stencils.
  - 5. Valve tags.
  - 6. Warning tags.

#### **1.3 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

#### **1.4 COORDINATION**

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

### **PART 2 - PRODUCTS**

#### **2.1 EQUIPMENT LABELS**

- A. Metal Labels for Equipment:
  - 1. Material and Thickness: Brass, 0.032-inch; stainless steel, 0.025-inch; aluminum, 0.032-inch; or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
  - 2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
  - 3. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  - 4. Fasteners: Stainless-steel rivets or self-tapping screws.
  - 5. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:
  - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
  - 2. Letter Color: White.
  - 3. Background Color: Black.

4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
  5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (.
  6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  7. Fasteners: Stainless-steel rivets or self-tapping screws.
  8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.
- D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

## 2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: White.
- C. Background Color: Red.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information, plus emergency notification instructions.

## 2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
  1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
  2. Lettering Size: At least 1-1/2 inches high.

## 2.4 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
  1. Tag Material: Brass, 0.032-inch; stainless steel, 0.025-inch; aluminum, 0.032-inch; or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.

2. Fasteners: Brass wire-link or beaded chain; or S-hook.

- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
1. Valve-tag schedule shall be included in operation and maintenance data.
  2. Provide framed ready-to-hang water valve shut-off location directory.

## 2.5 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
1. Size: 3 by 5-1/4 inches minimum.
  2. Fasteners: Brass grommet and wire or reinforced grommet and wire or string.
  3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
  4. Color: Yellow background with black lettering.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

### 3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

### 3.3 PIPE LABEL INSTALLATION

- A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
1. Near each valve and control device.
  2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  4. At access doors, manholes, and similar access points that permit view of concealed piping.
  5. Near major equipment items and other points of origination and termination.
  6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

### 3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
1. Valve-Tag Size and Shape:
    - a. Cold Water: 2 inches, round.
    - b. Hot Water: 2 inches, round.
  2. Valve-Tag Color:
    - a. Cold Water: Natural or green.
    - b. Hot Water: Natural or green.
  3. Letter Color:
    - a. Cold Water: Black or white.
    - b. Hot Water: Black or white.

### 3.5 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

**END OF SECTION 220553**



## **SECTION 220719 - PLUMBING PIPING 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 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Detail insulation application at elbows, fittings, flanges, valves, and specialties.
  - 3. Detail removable insulation at piping specialties, equipment connections, and access panels.
  - 4. Detail application of field-applied jackets and fitting covers.
- C. LEED Submittals:
  - 1. Product Data for Credit IEQ 4.1: For adhesives and sealants, documentation including printed statement of VOC content and chemical components.
  - 2. Laboratory Test Reports for Credit IEQ 4: For adhesives and sealants, documentation indicating that product complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

#### **1.3 QUALITY ASSURANCE**

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

#### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

#### **1.5 COORDINATION**

- A. Coordinate sizes and locations of supports, hangers, and insulation shields.
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

#### **1.6 SCHEDULING**

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on piping segments that have satisfactory test results.

## PART 2 - PRODUCTS

### 2.1 INSULATION MATERIALS

- A. Comply with requirements in "Plumbing Piping Insulation Schedule" for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Mineral-Fiber, Preformed Pipe Insulation:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Johns Manville; Micro-Lok.
    - b. Knauf Insulation; 1000-Degree Pipe Insulation.
    - c. Owens Corning; Fiberglas Pipe Insulation.
    - d. Pre-approved equal.
  - 2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL.
- D. Flexible Elastomeric Insulation: Closed-cell, expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Aeroflex USA, Inc.; Aerocel.
    - b. Armacell LLC; AP Armaflex.
    - c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.
    - d. Pre-approved equal.

### 2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.
  - 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

### 2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
  - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Foster Brand; 30-80/30-90.
    - b. Vimasco Corporation; 749.
    - c. Pre-approved equal.
  - 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
  - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
  - 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
  - 5. Color: White.

### 2.4 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.
  - 1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Products: Subject to compliance with requirements, provide one of the following:

- a. Childers Brand; CP-50 AHV2.
  - b. Foster Brand; 30-36.
  - c. Vimasco Corporation; 713 and 714.
  - d. Pre-approved equal.
3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
4. Service Temperature Range: 0 to plus 180 deg F.
5. Color: White.

## 2.5 SEALANTS

### A. Joint Sealants:

1. Joint Sealants for Flexible Elastomeric Products: Subject to compliance with requirements, provide one of the following:
  - a. Childers Brand; CP-76.
  - b. Foster Brand; 30-45.
  - c. Pittsburgh Corning Corporation; Pittseal 444.
  - d. Pre-approved equal.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F.
5. Color: White or gray.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

### B. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.6 FACTORY-APPLIED JACKETS

### A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

## 2.7 FIELD-APPLIED JACKETS

### A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

### B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Johns Manville; Zeston.
  - b. P.I.C. Plastics, Inc.; FG Series.
  - c. Proto Corporation; LoSmoke.
  - d. Speedline Corporation; SmokeSafe.
  - e. Pre-approved equal.
2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. Factory-fabricated fitting covers.
  - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

## 2.8 TAPES

### A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:

- a. ABI; 428 AWF ASJ.
    - b. Avery Dennison Corporation; Fasson 0836.
    - c. Compac Corporation; 104 and 105.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
    - e. Pre-approved equal.
  - 2. Width: 3 inches.
  - 3. Thickness: 11.5 mils.
  - 4. Adhesion: 90 ounces force/inch in width.
  - 5. Elongation: 2 percent.
  - 6. Tensile Strength: 40 lbf/inch in width.
  - 7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
- 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. ABI; 370 White PVC tape.
    - b. Compac Corporation; 130.
    - c. Venture Tape; 1506 CW NS.
    - d. Pre-approved equal.
  - 2. Width: 2 inches.
  - 3. Thickness: 6 mils.
  - 4. Adhesion: 64 ounces force/inch in width.
  - 5. Elongation: 500 percent.
  - 6. Tensile Strength: 18 lbf/inch in width.

## 2.9 SECUREMENTS

- A. Staples for Hot Service Only: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

## 2.10 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Insul-Tect Products Co.; a subsidiary of MVG Molded Products.
    - b. Plumberex.
    - c. Truebro; a brand of IPS Corporation.
    - d. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
    - e. Pre-approved equal.
  - 2. Description: Manufactured plastic wraps for covering plumbing fixture hot-water supply and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  - 1. Verify that systems to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, no penetrations of the insulation shall occur at hangers, supports, anchors, and other projections. Seal joints and seams with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
    - a. For below-ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.

3. Nameplates and data plates.
4. Cleanouts.

### 3.4 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
  1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- C. Insulation Installation at Floor Penetrations:
  1. Pipe: Install insulation continuously through floor penetrations.
  2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

### 3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
  1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
  2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
  6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. For services, except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Finish exposed surfaces with a PVC jacket.

### 3.6 INSTALLATION OF MINERAL-FIBER INSULATION

#### A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

#### B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

#### C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

#### D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

### 3.7 FIELD-APPLIED JACKET INSTALLATION

#### A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

### 3.8 FIELD QUALITY CONTROL

#### A. All insulation applications will be considered defective Work if inspection reveals noncompliance with requirements.

## END OF SECTION 220719





## **SECTION 221116 - DOMESTIC WATER PIPING**

### **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. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
  - 2. Encasement for piping.
  - 3. Specialty valves.
  - 4. Flexible connectors.
  - 5. Escutcheons.
  - 6. Sleeves and sleeve seals.
  - 7. Wall penetration systems.
- B. Related Section:
  - 1. Division 22 Section "Facility Water Distribution Piping" for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.
- C. Reference Documents:
  - 1. ASTM F 2389-06 - Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems.
  - 2. CSA B137.11 - Polypropylene (PP-R) Pipe and Fittings for Pressure Applications.
  - 3. NSF/ANSI 14 – Plastic Piping System Components and Related Materials.
  - 4. NSF/ANSI 61 – Drinking Water Systems Components – Health Effects.
- D. Definitions:
  - 1. Definitions shall be in accordance with local plumbing codes and ASTM F 2389.

#### **1.3 SUBMITTALS**

- A. Product Data: For the following products:
  - 1. Specialty valves.
  - 2. Transition fittings.
  - 3. Dielectric fittings.
  - 4. Flexible connectors.
  - 5. Backflow preventers and vacuum breakers.
  - 6. Escutcheons.
  - 7. Sleeves and sleeve seals.
  - 8. Water penetration systems.
  - 9. Piping.
- B. Water Samples: Specified in "Cleaning" Article.
- C. Coordination Drawings: For piping in equipment rooms and other congested areas, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
  - 1. Fire-suppression-water piping.
  - 2. Domestic water piping.
  - 3. Compressed air piping.
  - 4. HVAC hydronic piping.
- D. Field quality-control reports.

#### **1.4 QUALITY ASSURANCE**

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

- B. Comply with NSF 61 for potable domestic water piping and components.
- C. Material shall be certified by NSF International as complying with NSF 14, NSF 61, and ASTM F 2389 or CSA B137.11.
- D. Material shall comply with manufacturers specifications.
- E. Special Engineered products shall be certified by NSF International as complying with NSF 14.

#### 1.5 PROJECT CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
  1. Notify Architect, Construction Manager, or Owner no fewer than two days in advance of proposed interruption of water service.
  2. Do not proceed with interruption of water service without Architect's, Construction Manager's, or Owner's written permission.

#### 1.6 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

### PART 2 - PRODUCTS

#### 2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

#### 2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
  1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
  2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
  3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
  4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
  5. Copper Pressure-Seal-Joint Fittings:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Elkhart Products Corporation; Industrial Division.
      - 2) NIBCO INC.
      - 3) Viega; Plumbing and Heating Systems.
      - 4) Pre-approved equal.
    - b. NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.
    - c. NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber O-ring seal in each end.
  6. Copper-Tube Extruded-Tee Connections:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) T-DRILL Industries Inc.
      - 2) Pre-approved equal.
    - b. Description: Tee formed in copper tube according to ASTM F 2014.
  7. Grooved-Joint Copper-Tube Appurtenances:
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Anvil International.
      - 2) Shurjoint Piping Products.
      - 3) Victaulic Company.
      - 4) Pre-approved equal.
    - b. Copper Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.
    - c. Grooved-End-Tube Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, EPDM-rubber gaskets suitable for hot and cold water, and bolts and nuts.

- B. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L water tube, annealed temper.
  - 1. Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

## 2.3 DUCTILE-IRON PIPE AND FITTINGS

- A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated.
  - 1. Standard-Pattern, Mechanical-Joint Fittings: AWWA C110, ductile or gray iron.
  - 2. Compact-Pattern, Mechanical-Joint Fittings: AWWA C153, ductile iron.
    - a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated.
  - 1. Standard-Pattern, Push-on-Joint Fittings: AWWA C110, ductile or gray iron.
    - a. Gaskets: AWWA C111, rubber.
  - 2. Compact-Pattern, Push-on-Joint Fittings: AWWA C153, ductile iron.
    - a. Gaskets: AWWA C111, rubber.

## 2.4 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free, unless otherwise indicated; full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

## 2.5 ENCASEMENT FOR PIPING

- A. Standard: ASTM A 674 or AWWA C105.
- B. Form: Sheet or tube.
- C. Material: LLDPE film of 0.008-inch minimum thickness or high-density, cross-laminated PE film of 0.004-inch minimum thickness.
- D. Color: Black or natural.

## 2.6 SPECIALTY VALVES

- A. Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for general-duty metal valves.
- B. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

## 2.7 TRANSITION FITTINGS

- A. General Requirements:
  - 1. Same size as pipes to be joined.
  - 2. Pressure rating at least equal to pipes to be joined.
  - 3. End connections compatible with pipes to be joined.
- B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
- C. Sleeve-Type Transition Coupling: AWWA C219.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Cascade Waterworks Manufacturing.
- b. Dresser, Inc.; Dresser Piping Specialties.
- c. Ford Meter Box Company, Inc. (The).
- d. JCM Industries.
- e. Romac Industries, Inc.
- f. Smith-Blair, Inc; a Sensus company.
- g. Viking Johnson; c/o Mueller Co.
- h. Pre-approved equal.

## 2.8 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Capitol Manufacturing Company.
    - b. Central Plastics Company.
    - c. EPCO Sales, Inc.
    - d. Hart Industries International, Inc.
    - e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    - f. Zurn Plumbing Products Group; Wilkins Water Control Products.
    - g. Pre-approved equal.
  - 2. Description:
    - a. Pressure Rating: 150 psig at 180 deg F.
    - b. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Capitol Manufacturing Company.
    - b. Central Plastics Company.
    - c. EPCO Sales, Inc.
    - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    - e. Pre-approved equal.
  - 2. Description:
    - a. Factory-fabricated, bolted, companion-flange assembly.
    - b. Pressure Rating: 175 psig minimum.
    - c. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Kits:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Central Plastics Company.
    - d. Pipeline Seal and Insulator, Inc.
    - e. Pre-approved equal.
  - 2. Description:
    - a. Nonconducting materials for field assembly of companion flanges.
    - b. Pressure Rating: 150 psig.
    - c. Gasket: Neoprene or phenolic.
    - d. Bolt Sleeves: Phenolic or polyethylene.
    - e. Washers: Phenolic with steel backing washers.
- E. Dielectric Couplings:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Calpico, Inc.
    - b. Lochinvar Corporation.
    - c. Pre-approved equal.
  - 2. Description:
    - a. Galvanized-steel coupling.
    - b. Pressure Rating: 300 psig at 225 deg F.
    - c. End Connections: Female threaded.

- d. Lining: Inert and noncorrosive, thermoplastic.

F. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Perfection Corporation; a subsidiary of American Meter Company.
  - b. Precision Plumbing Products, Inc.
  - c. Victaulic Company.
  - d. Pre-approved equal.
2. Description:
  - a. Electroplated steel nipple complying with ASTM F 1545.
  - b. Pressure Rating: 300 psig at 225 deg F.
  - c. End Connections: Male threaded or grooved.
  - d. Lining: Inert and noncorrosive, propylene.

2.9 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flex-Hose Co., Inc.
2. Flexicraft Industries.
3. Flex Pression, Ltd.
4. Flex-Weld, Inc.
5. Hyspan Precision Products, Inc.
6. Mercer Rubber Co.
7. Metraflex, Inc.
8. Proco Products, Inc.
9. Tozen Corporation.
10. Unaflex, Inc.
11. Universal Metal Hose; a Hyspan company.
12. Pre-approved equal.

B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2) and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

C. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

2.10 ESCUTCHEONS

A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.

B. One Piece, Cast Brass: Polished, chrome-plated finish with setscrews.

C. One Piece, Deep Pattern: Deep-drawn, box-shaped brass with chrome-plated finish.

D. One Piece, Stamped Steel: Chrome-plated finish with setscrew.

E. Split Casting, Cast Brass: Polished, chrome-plated finish with concealed hinge and setscrew.

F. Split Plate, Stamped Steel: Chrome-plated finish with concealed hinge, setscrew.

G. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

H. Split-Casting Floor Plates: Cast brass with concealed hinge.

## 2.11 SLEEVES

- A. Cast-Iron Wall Pipes: Fabricated of cast iron, and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- C. Molded-PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- D. Molded-PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.
- E. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- F. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc-coated, with plain ends.
- G. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
  - 1. Underdeck Clamp: Clamping ring with setscrews.

## 2.12 SLEEVE SEALS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Advance Products & Systems, Inc.
  - 2. Calpico, Inc.
  - 3. Metraflex, Inc.
  - 4. Pipeline Seal and Insulator, Inc.
  - 5. Pre-approved equal.
- B. Description: Modular sealing element unit, designed for field assembly, used to fill annular space between pipe and sleeve.
  - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 2. Pressure Plates: Carbon steel or stainless steel.
  - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, or stainless steel of length required to secure pressure plates to sealing elements.

## 2.13 GROUT

- A. Standard: ASTM C 1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 EARTHWORK

- A. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

### 3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install underground copper tube and ductile-iron pipe in PE encasement according to ASTM A 674 or AWWA C105.
- E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.
- F. Install shutoff valve immediately upstream of each dielectric fitting.
- G. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for pressure-reducing valves.
- H. Install domestic water piping level without pitch and plumb.
- I. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- J. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- K. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- M. Install piping adjacent to equipment and specialties to allow service and maintenance.
- N. Install piping to permit valve servicing.
- O. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
- P. Install piping free of sags and bends.
- Q. Install fittings for changes in direction and branch connections.
- R. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- S. Install pressure gages on suction and discharge piping from each plumbing pump and packaged booster pump. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages.
- T. Install thermostats in hot-water circulation piping. Comply with requirements in Division 22 Section "Domestic Water Pumps" for thermostats.
- U. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers.

### 3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Braze Joints" Chapter.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

- E. Pressure-Sealed Joints: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- F. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.
- G. Copper-Tubing Grooved Joints: Roll groove end of tube. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for roll-grooved joints.
- H. Ductile-Iron-Piping Grooved Joints: Cut groove end of pipe. Assemble coupling with housing, gasket, lubricant, and bolts. Join ductile-iron pipe and grooved-end fittings according to AWWA C606 for ductile-iron-pipe, cut-grooved joints.
- I. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- J. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

### 3.4 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.
- C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."
  - 1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
  - 2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.
- D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 and smaller and butterfly valves for piping NPS 2-1/2 and larger. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.
- E. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for calibrated balancing valves.

### 3.5 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
  - 1. NPS 1-1/2 and Smaller: Fitting-type coupling.
  - 2. NPS 2 and Larger: Sleeve-type coupling.

### 3.6 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric unions.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges.
- D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.



### 3.7 FLEXIBLE CONNECTOR INSTALLATION

- A. Install flexible connectors in suction and discharge piping connections to each domestic water pump and in suction and discharge manifold connections to each domestic water booster pump.
- B. Install bronze-hose flexible connectors in copper domestic water tubing.

### 3.8 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.
  - 1. Vertical Piping: MSS Type 8 or 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet If Indicated: MSS Type 49, spring cushion rolls.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
  - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
  - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
  - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
  - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
  - 6. NPS 6: 10 feet with 5/8-inch rod.
  - 7. NPS 8: 10 feet with 3/4-inch rod.
- E. Install supports for vertical copper tubing every 10 feet.
- F. Install vinyl-coated hangers for PEX piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 2 and Smaller: 32 inches with 3/8-inch rod.
- G. Install hangers for vertical PEX piping every 48 inches
- H. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

### 3.9 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
  - 1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
  - 2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
  - 3. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.
  - 4. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

### 3.10 ESCUTCHEON INSTALLATION

- A. Install escutcheons for penetrations of walls, ceilings, and floors.
- B. Escutcheons for New Piping:
  - 1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
  - 2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish.
  - 3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece or split casting, cast brass with polished chrome-plated finish.
  - 4. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish.
  - 5. Bare Piping in Equipment Rooms: One piece, cast brass.
  - 6. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.

### 3.11 SLEEVE INSTALLATION

- A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
- B. Sleeves are not required for core-drilled holes.
- C. Permanent sleeves are not required for holes formed by removable PE sleeves.
- D. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
- E. Install sleeves in new partitions, slabs, and walls as they are built.
- F. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.
- G. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants" for joint sealants.
- H. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals specified in this Section.
- I. Seal space outside of sleeves in concrete slabs and walls with grout.
- J. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.
- K. Install sleeve materials according to the following applications:
  - 1. Sleeves for Piping Passing through Concrete Floor Slabs: Molded PE, molded PVC, or steel pipe.
  - 2. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Steel pipe or stack sleeve fittings.
    - a. Extend sleeves 2 inches above finished floor level.
    - b. For pipes penetrating floors with membrane waterproofing, extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Comply with requirements in Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
  - 3. Sleeves for Piping Passing through Concrete Roof Slabs: Molded PE, molded PVC, or steel pipe.
  - 4. Sleeves for Piping Passing through Exterior Concrete Walls:
    - a. Steel pipe sleeves for pipes smaller than NPS 6.
    - b. Cast-iron wall pipe sleeves for pipes NPS 6 and larger.
    - c. Install sleeves that are large enough to provide 1-inch annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.
    - d. Do not use sleeves when wall penetration systems are used.
  - 5. Sleeves for Piping Passing through Interior Concrete Walls:
    - a. Steel pipe sleeves for pipes smaller than NPS 6.
    - b. Galvanized-steel sheet sleeves for pipes NPS 6 and larger.

- L. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestop materials and installations.

### 3.12 SLEEVE SEAL INSTALLATION

- A. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.
- B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### 3.13 WALL PENETRATION SYSTEM INSTALLATION

- A. Install wall penetration systems in new, exterior concrete walls.
- B. Assemble wall penetration system components with sleeve pipe. Install so that end of sleeve pipe and face of housing are flush with wall. Adjust locking devices to secure sleeve pipe in housing.

### 3.14 IDENTIFICATION

- A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.
- B. Label pressure piping with system operating pressure.

### 3.15 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Piping Inspections:
  - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
  - 2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
    - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
  - 3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
  - 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- C. Piping Tests:
  - 1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
  - 2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
  - 3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - 4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
  - 5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
  - 6. Prepare reports for tests and for corrective action required.
- D. Domestic water piping will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

### 3.16 ADJUSTING

- A. Perform the following adjustments before operation:
  - 1. Close drain valves, hydrants, and hose bibbs.
  - 2. Open shutoff valves to fully open position.
  - 3. Open throttling valves to proper setting.
  - 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
    - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
    - b. Adjust calibrated balancing valves to flows indicated.
  - 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
  - 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
  - 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
  - 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

### 3.17 CLEANING

- A. Clean and disinfect potable and non-potable domestic water piping as follows:
  - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
  - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
    - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    - b. Fill and isolate system according to either of the following:
      - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
      - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
    - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Clean non-potable domestic water piping as follows:
  - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
  - 2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
    - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    - b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- C. Prepare and submit reports of purging and disinfecting activities.
- D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

### 3.18 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Under-building-slab, domestic water, building service piping, NPS 3 and smaller, shall be one of the following:
  - 1. Soft copper tube, ASTM B 88, Type K or ASTM B 88, Type L; wrought-copper solder-joint fittings; and brazed joints.
- E. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 8 and larger, shall be one of the following:

1. Mechanical-joint, ductile-iron pipe; standard- or compact-pattern mechanical-joint fittings; and mechanical joints.
2. Push-on-joint, ductile-iron pipe; standard- or compact-pattern push-on-joint fittings; and gasketed joints.

F. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper solder-joint fittings; and brazed or soldered joints.
2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.

G. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper solder-joint fittings; and brazed or soldered joints.
2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.

H. Aboveground domestic water piping, NPS 5 to NPS 8, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper solder-joint fittings; and brazed or soldered joints.
2. Hard copper tube, ASTM B 88, Type L; grooved-joint copper-tube appurtenances; and grooved joints.

### 3.19 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water Circulation Piping, Balancing Duty: Calibrated memory-stop balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

### END OF SECTION 221116



## **SECTION 221119 - DOMESTIC WATER PIPING SPECIALTIES**

### **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 domestic water piping specialties:
  - 1. Vacuum breakers.
  - 2. Backflow preventers.
  - 3. Water pressure-reducing valves.
  - 4. Balancing valves.
  - 5. Temperature-actuated water mixing valves.
  - 6. Strainers.
  - 7. Outlet boxes.
  - 8. Hose bibbs.
  - 9. Wall hydrants.
  - 10. Drain valves.
  - 11. Water hammer arresters.
  - 12. Air vents.
  - 13. Trap-seal primer valves.
  - 14. Trap-seal primer systems.
- B. Related Sections include the following:
  - 1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
  - 2. Division 22 Section "Domestic Water Piping" for water meters.
  - 3. Division 22 Section "Domestic Water Filtration Equipment" for water filters in domestic water piping.
  - 4. Division 22 Section "Healthcare Plumbing Fixtures" for thermostatic mixing valves for sitz baths, thermostatic mixing-valve assemblies for hydrotherapy equipment, and outlet boxes for dialysis equipment.
  - 5. Division 22 Section "Emergency Plumbing Fixtures" for water tempering equipment.
  - 6. Division 22 Section "Drinking Fountains and Water Coolers" for water filters for water coolers.

#### **1.3 PERFORMANCE REQUIREMENTS**

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

#### **1.4 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

#### **1.5 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. NSF Compliance:
  - 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
  - 2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

## PART 2 - PRODUCTS

### 2.1 VACUUM BREAKERS

- A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Ames Co.
    - b. Cash Acme.
    - c. Conbraco Industries, Inc.
    - d. FEBCO; SPX Valves & Controls.
    - e. Rain Bird Corporation.
    - f. Toro Company (The); Irrigation Div.
    - g. Watts Industries, Inc.; Water Products Div.
    - h. Zurn Plumbing Products Group; Wilkins Div.
    - i. Pre-approved equal.
  2. Standard: ASSE 1001.
  3. Size: NPS 1/4 to NPS 3, as required to match connected piping.
  4. Body: Bronze.
  5. Inlet and Outlet Connections: Threaded.
  6. Finish: Rough bronze or chrome plated where in public view.
- B. Hose-Connection Vacuum Breakers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Arrowhead Brass Products, Inc.
    - b. Cash Acme.
    - c. Conbraco Industries, Inc.
    - d. Legend Valve.
    - e. MIFAB, Inc.
    - f. Prier Products, Inc.
    - g. Watts Industries, Inc.; Water Products Div.
    - h. Woodford Manufacturing Company.
    - i. Zurn Plumbing Products Group; Light Commercial Operation.
    - j. Zurn Plumbing Products Group; Wilkins Div.
    - k. Pre-approved equal.
  2. Standard: ASSE 1011.
  3. Body: Bronze, nonremovable, with manual drain.
  4. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
  5. Finish: Chrome or nickel plated or rough bronze where in public view.
- C. Pressure Vacuum Breakers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Ames Co.
    - b. Conbraco Industries, Inc.
    - c. FEBCO; SPX Valves & Controls.
    - d. Flomatic Corporation.
    - e. Toro Company (The); Irrigation Div.
    - f. Watts Industries, Inc.; Water Products Div.
    - g. Zurn Plumbing Products Group; Wilkins Div.
    - h. Pre-approved equal.
  2. Standard: ASSE 1020.
  3. Operation: Continuous-pressure applications.
  4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
  5. Accessories:
    - a. Valves: Ball type, on inlet and outlet.
- D. Laboratory-Faucet Vacuum Breakers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Conbraco Industries, Inc.
    - b. Watts Industries, Inc.; Water Products Div.
    - c. Woodford Manufacturing Company.
    - d. Zurn Plumbing Products Group; Wilkins Div.
    - e. Pre-approved equal.
  2. Standard: ASSE 1035.



3. Size: NPS 1/4 or NPS 3/8 matching faucet size.
4. Body: Bronze.
5. End Connections: Threaded.
6. Finish: Chrome plated.

E. Spill-Resistant Vacuum Breakers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Conbraco Industries, Inc.
  - b. Watts Industries, Inc.; Water Products Div.
  - c. Pre-approved equal.
2. Standard: ASSE 1056.
3. Operation: Continuous-pressure applications.
4. Accessories:
  - a. Valves: Ball type, on inlet and outlet.

## 2.2 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Conbraco Industries, Inc.
  - b. FEBCO; SPX Valves & Controls.
  - c. Watts Industries, Inc.; Water Products Div.
  - d. Zurn Plumbing Products Group; Wilkins Div.
  - e. Pre-approved equal.
2. Standard: ASSE 1012.
3. Operation: Continuous-pressure applications.
4. Body: Bronze.
5. End Connections: Union, solder joint.
6. Finish: Rough bronze.

B. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Conbraco Industries, Inc.
  - b. FEBCO; SPX Valves & Controls.
  - c. Watts Industries, Inc.; Water Products Div.
  - d. Zurn Plumbing Products Group; Wilkins Div.
  - e. Pre-approved equal.
2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
5. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
7. Configuration: Designed for horizontal, straight through; vertical inlet, horizontal center section, and vertical outlet; or vertical where space constraints require, flow.
8. Accessories:
  - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
  - b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

C. Double-Check Backflow-Prevention Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Conbraco Industries, Inc.
  - b. FEBCO; SPX Valves & Controls.
  - c. Watts Industries, Inc.; Water Products Div.
  - d. Zurn Plumbing Products Group; Wilkins Div.
  - e. Pre-approved equal.
2. Standard: ASSE 1015.
3. Operation: Continuous-pressure applications, unless otherwise indicated.
4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
5. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and larger.
6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

7. Configuration: Designed for horizontal, straight through flow.
  8. Accessories:
    - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
- D. Beverage-Dispensing-Equipment Backflow Preventers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Conbraco Industries, Inc.
    - b. Watts Industries, Inc.; Water Products Div.
    - c. Zurn Plumbing Products Group; Wilkins Div.
    - d. Pre-approved equal.
  2. Standard: ASSE 1022.
  3. Operation: Continuous-pressure applications.
  4. Size: NPS 1/4 or NPS 3/8.
  5. Body: Stainless steel.
  6. End Connections: Threaded.
- E. Dual-Check-Valve Backflow Preventers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Conbraco Industries, Inc.
    - b. FEBCO; SPX Valves & Controls.
    - c. Watts Industries, Inc.; Water Products Div.
    - d. Zurn Plumbing Products Group; Wilkins Div.
    - e. Pre-approved equal.
  2. Standard: ASSE 1024.
  3. Operation: Continuous-pressure applications.
  4. Body: Bronze with union inlet.
- F. Carbonated-Beverage-Dispenser, Dual-Check-Valve Backflow Preventers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Cash Acme.
    - b. Lancer Corporation.
    - c. Watts Industries, Inc.; Water Products Div.
    - d. Pre-approved equal.
  2. Standard: ASSE 1032.
  3. Operation: Continuous-pressure applications.
  4. Size: NPS 1/4 or NPS 3/8.
  5. Body: Stainless steel.
  6. End Connections: Threaded.
- G. Double-Check, Detector-Assembly Backflow Preventers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Conbraco Industries, Inc.
    - b. FEBCO; SPX Valves & Controls.
    - c. Watts Industries, Inc.; Water Products Div.
    - d. Zurn Plumbing Products Group; Wilkins Div.
    - e. Pre-approved equal.
  2. Standard: ASSE 1048 and FMG approved or UL listed.
  3. Operation: Continuous-pressure applications.
  4. Pressure Loss: 5 psig maximum, through middle 1/3 of flow range.
  5. Body: Cast iron with interior lining complying with AWWA C550 or that is FDA approved.
  6. End Connections: Flanged.
  7. Configuration: Designed for horizontal, straight through; vertical inlet, horizontal center section, and vertical outlet; or vertical flow where space constraints require.
  8. Accessories:
    - a. Valves: Outside screw and yoke gate-type with flanged ends on inlet and outlet.
    - b. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.
- H. Hose-Connection Backflow Preventers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Conbraco Industries, Inc.
    - b. Watts Industries, Inc.; Water Products Div.

- c. Woodford Manufacturing Company.
- d. Pre-approved equal.
- 2. Standard: ASSE 1052.
- 3. Operation: Up to 10-foot head of water back pressure.
- 4. Inlet Size: NPS 1/2 or NPS 3/4.
- 5. Outlet Size: Garden-hose thread complying with ASME B1.20.7.
- 6. Capacity: At least 3-gpm flow.

I. Backflow-Preventer Test Kits:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Conbraco Industries, Inc.
  - b. FEBCO; SPX Valves & Controls.
  - c. Flomatic Corporation.
  - d. Watts Industries, Inc.; Water Products Div.
  - e. Zurn Plumbing Products Group; Wilkins Div.
  - f. Pre-approved equal.
- 2. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

## 2.3 WATER PRESSURE-REDUCING VALVES

A. Water Regulators:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Watts Industries, Inc.; Water Products Div. for 4" valves and larger, no exceptions allowed.
  - b. Wilkins, Cla-Val, Febco, or Conbraco for valves smaller than 4", no other manufacturer's allowed.
- 2. Standard: ASSE 1003.
- 3. Pressure Rating: Initial working pressure of 150 psig.
- 4. Body: Bronze with chrome-plated finish for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
- 5. Valves for Booster Heater Water Supply: Include integral bypass.
- 6. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

B. Water Control Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. CLA-VAL Automatic Control Valves.
  - b. Flomatic Corporation.
  - c. OCV Control Valves.
  - d. Watts Industries, Inc.; Ames Fluid Control Systems.
  - e. Watts Industries, Inc.; Watts ACV.
  - f. Zurn Plumbing Products Group; Wilkins Div.
  - g. Pre-approved equal.
- 2. Description: Pilot-operation, diaphragm-type, single-seated main water control valve.
- 3. Pressure Rating: Initial working pressure of 150 psig minimum with AWWA C550 or FDA-approved, interior epoxy coating. Include small pilot-control valve, restrictor device, specialty fittings, and sensor piping.
- 4. Main Valve Body: Cast- or ductile-iron body with AWWA C550 or FDA-approved, interior epoxy coating; or stainless-steel body.
  - a. Pattern: Angle- or globe-valve design.
  - b. Trim: Stainless steel.
- 5. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

## 2.4 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Armstrong International, Inc.
  - b. ITT Industries; Bell & Gossett Div.
  - c. NIBCO INC.
  - d. TAC Americas.
  - e. Taco, Inc.
  - f. Watts Industries, Inc.; Water Products Div.
  - g. Pre-approved equal.
- 2. Type: Ball or Y-pattern globe valve with two readout ports and memory setting indicator.
- 3. Body: Brass or bronze.

4. Size: Same as connected piping, but not larger than NPS 2.
5. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Cast-Iron Calibrated Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Armstrong International, Inc.
  - b. Flo Fab Inc.
  - c. ITT Industries; Bell & Gossett Div.
  - d. NIBCO INC.
  - e. TAC Americas.
  - f. Watts Industries, Inc.; Water Products Div.
  - g. Pre-approved equal.
2. Type: Adjustable with Y-pattern globe valve, two readout ports, and memory-setting indicator.
3. Size: Same as connected piping, but not smaller than NPS 2-1/2.

C. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

D. Memory-Stop Balancing Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Conbraco Industries, Inc.
  - b. Crane Co.; Crane Valve Group; Crane Valves.
  - c. Crane Co.; Crane Valve Group; Jenkins Valves.
  - d. Crane Co.; Crane Valve Group; Stockham Div.
  - e. Hammond Valve.
  - f. Milwaukee Valve Company.
  - g. NIBCO INC.
  - h. Red-White Valve Corp.
  - i. Pre-approved equal.
2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
3. Pressure Rating: 400-psig minimum CWP.
4. Size: NPS 2 or smaller.
5. Body: Copper alloy.
6. Port: Standard or full port.
7. Ball: Chrome-plated brass.
8. Seats and Seals: Replaceable.
9. End Connections: Solder joint or threaded.
10. Handle: Vinyl-covered steel with memory-setting device.

## 2.5 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining complying with AWWA C550 or FDA-approved, epoxy coating and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:
  - a. Strainers NPS 2 and Smaller: 0.020 inch.
  - b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
  - c. Strainers NPS 5 and Larger: 0.10 inch.
6. Drain: Pipe plug.

## 2.6 OUTLET BOXES

A. Clothes Washer Outlet Boxes:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Acorn Engineering Company.
  - b. Guy Gray Manufacturing Co., Inc.
  - c. IPS Corporation.
  - d. LSP Products Group, Inc.
  - e. Oatey.
  - f. Plastic Oddities; a division of Diverse Corporate Technologies.
  - g. Symmons Industries, Inc.

- h. Watts Industries, Inc.; Water Products Div.
- i. Whitehall Manufacturing; a div. of Acorn Engineering Company.
- j. Zurn Plumbing Products Group; Light Commercial Operation.
- k. Pre-approved equal.
- 2. Mounting: Recessed.
- 3. Material and Finish: Enameled-steel or epoxy-painted-steel box and faceplate.
- 4. Faucet: Combination, valved fitting or separate hot- and cold-water, valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
- 5. Supply Shutoff Fittings: NPS 1/2 gate, globe, or ball valves and NPS 1/2 copper, water tubing.
- 6. Drain: NPS 2 standpipe and P-trap for direct waste connection to drainage piping.
- 7. Inlet Hoses: Two 60-inch-long, rubber household clothes washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.
- 8. Drain Hose: One 48-inch-long, rubber household clothes washer drain hose with hooked end.

**B. Icemaker Outlet Boxes:**

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Acorn Engineering Company.
  - b. Guy Gray Manufacturing Co., Inc.
  - c. IPS Corporation.
  - d. LSP Products Group, Inc.
  - e. Oatey.
  - f. Plastic Oddities; a division of Diverse Corporate Technologies.
  - g. Pre-approved equal.
- 2. Mounting: Recessed.
- 3. Material and Finish: Enameled-steel or epoxy-painted-steel box and faceplate.
- 4. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
- 5. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.

## 2.7 HOSE BIBBS

**A. Hose Bibbs:**

- 1. Standard: ASME A112.18.1 for sediment faucets.
- 2. Body Material: Bronze.
- 3. Seat: Bronze, replaceable.
- 4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
- 5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
- 6. Pressure Rating: 125 psig.
- 7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
- 8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
- 9. Finish for Service Areas: Rough bronze or chrome or nickel plated.
- 10. Finish for Finished Rooms: Chrome or nickel plated.
- 11. Operation for Equipment Rooms: Wheel handle or operating key.
- 12. Operation for Service Areas: Operating key.
- 13. Operation for Finished Rooms: Operating key.
- 14. Include operating key with each operating-key hose bibb.
- 15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

## 2.8 WALL HYDRANTS

**A. Nonfreeze Wall Hydrants:**

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Josam Company.
  - b. MIFAB, Inc.
  - c. Prier Products, Inc.
  - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - e. Tyler Pipe; Wade Div.
  - f. Watts Drainage Products Inc.
  - g. Woodford Manufacturing Company.
  - h. Zurn Plumbing Products Group; Light Commercial Operation.
  - i. Zurn Plumbing Products Group; Specification Drainage Operation.
  - j. Pre-approved equal.
- 2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.

3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4 or NPS 1.
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounting with cover.
9. Box and Cover Finish: Polished nickel bronze.
10. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
11. Nozzle and Wall-Plate Finish: Polished nickel bronze.
12. Operating Keys(s): One with each wall hydrant.

B. Vacuum Breaker Wall Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Arrowhead Brass Products, Inc.
  - b. Mansfield Plumbing Products LLC.
  - c. McDonald, A. Y. Mfg. Co.
  - d. Prier Products, Inc.
  - e. Smith, Jay. R. Mfg. Co.; Division of Smith Industries, Inc.
  - f. Watts Industries, Inc.; Water Products Div.
  - g. Woodford Manufacturing Company.
  - h. Zurn Plumbing Products Group; Light Commercial Operation.
  - i. Pre-approved equal.
2. Standard: ASSE 1019, Type A or Type B.
3. Type: Freeze-resistant, automatic draining with integral air-inlet valve.
4. Classification: Type A, for automatic draining with hose removed or Type B, for automatic draining with hose removed or with hose attached and nozzle closed.
5. Pressure Rating: 125 psig.
6. Operation: Loose key.
7. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
8. Inlet: NPS 3/4.
9. Outlet: Exposed with garden-hose thread complying with ASME B1.20.7.

## 2.9 POST HYDRANTS

A. Nonfreeze, Draining-Type Post Hydrants:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. MIFAB, Inc.
  - b. Prier Products, Inc.
  - c. Simmons Manufacturing Co.
  - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - e. Tyler Pipe; Wade Div.
  - f. Watts Drainage Products Inc.
  - g. Woodford Manufacturing Company.
  - h. Zurn Plumbing Products Group; Light Commercial Operation.
  - i. Zurn Plumbing Products Group; Specification Drainage Operation.
  - j. Pre-approved equal.
2. Standard: ASME A112.21.3M.
3. Type: Nonfreeze, exposed-outlet post hydrant.
4. Operation: Loose key.
5. Casing and Operating Rod: Of at least length required for burial of valve below frost line.
6. Casing: Bronze with casing guard.
7. Inlet: NPS 3/4.
8. Outlet: Garden-hose thread complying with ASME B1.20.7.
9. Drain: Designed with hole to drain into ground when shut off.
10. Vacuum Breaker: Nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011; and garden-hose thread complying with ASME B1.20.7 on outlet.
11. Operating Key(s): Two with each loose-key-operation wall hydrant.

## 2.10 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.

3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

## 2.11 WATER HAMMER ARRESTERS

- A. Water Hammer Arresters:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. AMTROL, Inc.
    - b. Josam Company.
    - c. MIFAB, Inc.
    - d. PPP Inc.
    - e. Sioux Chief Manufacturing Company, Inc.
    - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - g. Tyler Pipe; Wade Div.
    - h. Watts Drainage Products Inc.
    - i. Zurn Plumbing Products Group; Specification Drainage Operation.
    - j. Pre-approved equal.
  2. Standard: ASSE 1010 or PDI-WH 201.
  3. Type: Metal bellows or copper tube with piston.
  4. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

## 2.12 AIR VENTS

- A. Bolted-Construction Automatic Air Vents:
  1. Body: Bronze.
  2. Pressure Rating: 125-psig minimum pressure rating at 140 deg F.
  3. Float: Replaceable, corrosion-resistant metal.
  4. Mechanism and Seat: Stainless steel.
  5. Size: NPS 3/8 minimum inlet.
  6. Inlet and Vent Outlet End Connections: Threaded.
- B. Welded-Construction Automatic Air Vents:
  1. Body: Stainless steel.
  2. Pressure Rating: 150-psig minimum pressure rating.
  3. Float: Replaceable, corrosion-resistant metal.
  4. Mechanism and Seat: Stainless steel.
  5. Size: NPS 3/8 minimum inlet.
  6. Inlet and Vent Outlet End Connections: Threaded.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
  1. Locate backflow preventers in same room as connected equipment or system.
  2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
  3. Do not install bypass piping around backflow preventers.
  4. Install backflow preventer between 12" above floor and 60" above floor so it is easily accessible without the use of a ladder.

- C. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.
- D. Install water control valves with inlet and outlet shutoff valves and bypass with globe valve. Install pressure gages on inlet and outlet.
- E. Install balancing valves in locations where they can easily be adjusted.
- F. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
  - 1. Install thermometers and water regulators if specified.
  - 2. Install cabinet-type units recessed in or surface mounted on wall as specified.
- G. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.
- H. Install outlet boxes recessed in wall. Install 2-by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."
- I. Install hose stations with check stops or shutoff valves on inlets and with thermometer on outlet.
  - 1. Install shutoff valve on outlet if specified.
  - 2. Install cabinet-type units recessed in or surface mounted on wall as specified. Install 2-by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."
- J. Install ground hydrants with 1 cu. yd. of crushed gravel around drain hole. Set ground hydrants with box flush with grade.
- K. Install draining-type post hydrants with 1 cu. yd. of crushed gravel around drain hole. Set post hydrants in concrete paving or in 1 cu. ft. of concrete block at grade.
- L. Install nonfreeze, nondraining-type post hydrants set in concrete or pavement.
- M. Install freeze-resistant yard hydrants with riser pipe set in concrete or pavement. Do not encase canister in concrete.
- N. Install water hammer arresters in water piping according to PDI-WH 201.
- O. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.

### 3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

### 3.3 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
  - 1. Pressure vacuum breakers.
  - 2. Intermediate atmospheric-vent backflow preventers.
  - 3. Reduced-pressure-principle backflow preventers.
  - 4. Double-check backflow-prevention assemblies.
  - 5. Carbonated-beverage-machine backflow preventers.
  - 6. Dual-check-valve backflow preventers.
  - 7. Reduced-pressure-detector, fire-protection backflow-preventer assemblies.
  - 8. Double-check, detector-assembly backflow preventers.



9. Water pressure-reducing valves.
10. Calibrated balancing valves.
11. Primary, thermostatic, water mixing valves.
12. Manifold, thermostatic, water-mixing-valve assemblies.
13. Photographic-process, thermostatic, water-mixing-valve assemblies.
14. Primary water tempering valves.
15. Outlet boxes.
16. Hose stations.
17. Supply-type, trap-seal primer valves.
18. Trap-seal primer systems.

- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

### 3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
  1. Test each reduced-pressure-principle backflow preventer, double-check backflow-prevention assembly and double-check, detector-assembly backflow preventer according to authorities having jurisdiction and the device's reference standard.
- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

### 3.5 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

**END OF SECTION 221119**



## **SECTION 221316 - SANITARY WASTE AND VENT PIPING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes the following soil and waste, sanitary drainage and vent piping inside the building:
  - 1. Pipe, tube, and fittings.
  - 2. Special pipe fittings.

#### **1.2 DEFINITIONS**

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.
- C. LLDPE: Linear, low-density polyethylene plastic.
- D. NBR: Acrylonitrile-butadiene rubber.
- E. PE: Polyethylene plastic.
- F. PVC: Polyvinyl chloride plastic.
- G. TPE: Thermoplastic elastomer.

#### **1.3 PERFORMANCE REQUIREMENTS**

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
  - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

#### **1.4 SUBMITTALS**

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Shop Drawings:
  - 1. Sovent Drainage System: Include plans, elevations, sections, and details.
- C. Field quality-control inspection and test reports.

#### **1.5 QUALITY ASSURANCE**

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; and "NSF-drain" for plastic drain piping.
- C. Cast iron soil pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and shall be listed by NSF International.
- D. CISPI Hubless Couplings (CISPI 310) shall be marked with NSF International.

### **PART 2 - PRODUCTS**

#### **2.1 MANUFACTURERS**

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

## 2.2 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

## 2.3 HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 74, Service class; manufactured by AB&I, Charolotte, or Tyler.
- B. Gaskets: ASTM C 564, rubber.
- C. Calking Materials: ASTM B 29, pure lead and oakum or hemp fiber.

## 2.4 HUBLESS CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301. manufactured by AB&I, Charolotte, or Tyler.
- B. Solvent Stack Fittings: ASME B16.45 or ASSE 1043, hubless, cast-iron aerator and deaerator drainage fittings.
- C. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
  1. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) ANACO.
      - 2) Mission Rubber Co.
      - 3) Tyler Pipe; Soil Pipe Div.
      - 4) Pre-approved equal.
  2. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) ANACO/Husky SD 4000.
      - 2) Clamp-All Corp.-125.
      - 3) Pre-approved equal.
  3. Heavy-Duty, Shielded, Cast-Iron Couplings: ASTM A 48/A 48M, two-piece, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve.
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) MG Piping Products Co.
      - 2) Pre-approved equal.

## 2.5 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
  1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.
- B. Solvent Cement and Adhesive Primer:
  1. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.6 SPECIAL PIPE FITTINGS

- A. Flexible, Nonpressure Pipe Couplings: Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition pattern. Include shear ring, ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Dallas Specialty & Mfg. Co.
    - b. Fernco, Inc.
    - c. Logan Clay Products Company (The).

- d. Mission Rubber Co.
  - e. NDS, Inc.
  - f. Plastic Oddities, Inc.
  - g. Pre-approved equal.
- 2. Sleeve Materials:
  - a. For Cast-Iron Soil Pipes: ASTM C 564, rubber.
  - b. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
  - c. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
- B. Expansion Joints: Two or three-piece, ductile-iron assembly consisting of telescoping sleeve(s) with gaskets and restrained-type, ductile-iron, bell-and-spigot end sections complying with AWWA C110 or AWWA C153. Select and assemble components for expansion indicated. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. EBAA Iron Sales, Inc.
    - b. Romac Industries, Inc.
    - c. Star Pipe Products; Star Fittings Div.
    - d. Pre-approved equal.
- C. Wall-Penetration Fittings: Compound, ductile-iron coupling fitting with sleeve and flexing sections for up to 20-degree deflection, gaskets, and restrained-joint ends complying with AWWA C110 or AWWA C153. Include AWWA C111, ductile-iron glands, rubber gaskets, and steel bolts.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. SIGMA Corp.
    - b. Pre-approved equal.

## 2.7 ENCASEMENT FOR UNDERGROUND METAL PIPING

- A. Description: ASTM A 674 or AWWA C105, high-density, crosslaminated PE film of 0.004-inch or LLDPE film of 0.008-inch minimum thickness.
- B. Form: Sheet or tube.
- C. Color: Black or natural.

## PART 3 - EXECUTION

### 3.1 PIPING APPLICATIONS

- A. Special pipe fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.
- B. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
- C. Aboveground, soil, waste, and vent piping shall be the following:
  - 1. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
- D. Underground, soil, waste, and vent piping NPS 15 and smaller shall be the following:
  - 1. Extra-Heavy class, cast-iron soil piping; gaskets; and gasketed joints.
  - 2. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 3. Dissimilar Pipe-Material Couplings: Flexible, nonpressure pipe couplings for joining dissimilar pipe materials with small difference in OD.

### 3.2 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Section "Basic Mechanical Materials and Methods."
- B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

- C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Section "Basic Mechanical Materials and Methods."
- D. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Section "Basic Mechanical Materials and Methods."
- E. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- F. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- G. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- H. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
  - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
  - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
  - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- I. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- J. Install ABS soil and waste drainage and vent piping according to ASTM D 2661.
- K. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.
- L. Install underground ABS and PVC soil and waste drainage piping according to ASTM D 2321.
- M. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

### 3.3 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- C. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead and oakum calked joints.
- D. Join hubless cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-coupling joints.
- E. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- F. Grooved Joints: Assemble joint with keyed coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- G. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

### 3.4 HANGER AND SUPPORT INSTALLATION

- A. Seismic-restraint devices are specified in Section "Mechanical Vibration and Seismic Controls."
- B. Pipe hangers and supports are specified in Section "Hangers and Supports." Install the following:
  - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Install supports according to Section "Hangers and Supports."
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
  - 2. NPS 3: 60 inches with 1/2-inch rod.
  - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
  - 4. NPS 6: 60 inches with 3/4-inch rod.
  - 5. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- G. Install supports for vertical cast-iron soil piping every 15 feet.
- H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.5 CONNECTIONS

- A. Connect soil and waste piping to existing sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- B. Connect drainage and vent piping to the following:
  - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code. Refer to Section "Plumbing Fixtures."
  - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
  - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code. Refer to Section "Plumbing Specialties."
  - 4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

### 3.6 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
  - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction.

1. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
2. Prepare reports for tests and required corrective action.

3.7 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

**END OF SECTION 221316**



## SECTION 221319 - SANITARY AND WASTE PIPING SPECIALTIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following drainage piping specialties:
  - 1. Cleanouts.
  - 2. Floor drains.
  - 3. Miscellaneous drainage piping specialties.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

#### 1.3 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

### PART 2 - PRODUCTS

#### 2.1 CLEANOUTS

- A. Exposed Cast-Iron Cleanouts:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 3. Basis-of-Design Product: Subject to compliance with requirements, provide a product by one of the following:
    - a. Josam Company; Josam Div.
    - b. MIFAB, Inc.
    - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - d. Tyler Pipe; Wade Div.
    - e. Watts Drainage Products Inc.
    - f. Zurn Plumbing Products Group; Specification Drainage Operation.
  - 4. Standard: ASME A112.36.2M for cast iron for cleanout test tee.
  - 5. Size: Same as connected drainage piping
  - 6. Body Material: Hubless, cast-iron soil pipe test tee as required to match connected piping.
  - 7. Closure: Countersunk, brass plug.
  - 8. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
- B. Cast-Iron Floor Cleanouts:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 3. Basis-of-Design Product: Subject to compliance with requirements, provide a product by one of the following:
    - a. Josam Company; Josam Div.
    - b. Oatey.
    - c. Sioux Chief Manufacturing Company, Inc.
    - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    - e. Tyler Pipe; Wade Div.
    - f. Watts Drainage Products Inc.
    - g. Zurn Plumbing Products Group; Light Commercial Operation.
    - h. Zurn Plumbing Products Group; Specification Drainage Operation.
  - 4. Standard: ASME A112.36.2M for heavy-duty, adjustable housing cleanout.
  - 5. Size: Same as connected branch.
  - 6. Type: Heavy-duty, adjustable housing.
  - 7. Body or Ferrule: Cast iron.
  - 8. Clamping Device: Required.

9. Outlet Connection: Inside calk.
10. Closure: Brass plug with straight threads and gasket.
11. Adjustable Housing Material: Cast iron with threads.
12. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
13. Frame and Cover Shape: Round.
14. Top Loading Classification: Heavy Duty.
15. Riser: ASTM A 74, Extra-Heavy class, cast-iron drainage pipe fitting and riser to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide a product by one of the following:
  - a. Josam Company; Josam Div.
  - b. MIFAB, Inc.
  - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - d. Tyler Pipe; Wade Div.
  - e. Watts Drainage Products Inc.
  - f. Zurn Plumbing Products Group; Specification Drainage Operation.
4. Standard: ASME A112.36.2M. Include wall access.
5. Size: Same as connected drainage piping.
6. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
7. Closure: Countersunk, brass plug.
8. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
9. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
10. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

## 2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide a product by one of the following:
  - a. Commercial Enameling Co.
  - b. Josam Company; Josam Div.
  - c. MIFAB, Inc.
  - d. Prier Products, Inc.
  - e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - f. Tyler Pipe; Wade Div.
  - g. Watts Drainage Products Inc.
  - h. Zurn Plumbing Products Group; Light Commercial Operation.
  - i. Zurn Plumbing Products Group; Specification Drainage Operation.
4. Floor drains shall be as scheduled on the drawings.

## 2.3 MISCELLANEOUS DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.
  - a. NPS 2: 4-inch-minimum water seal.
  - b. NPS 2-1/2 and Larger: 5-inch-minimum water seal.

C. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

D. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Refer to Division 22 Section "Basic Plumbing Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.
- B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
  1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
  2. Locate at each change in direction of piping greater than 90 degrees.
  3. Locate at minimum intervals per local code requirements.
  4. Locate at base of each vertical soil and waste stack.
- C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
  1. Position floor drains for easy access and maintenance.
  2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
    - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
  3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
  4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- F. Assemble open drain fittings and install with top of hub 1 inch above floor.
- G. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- H. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- I. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

### 3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

- B. Install piping adjacent to equipment to allow service and maintenance.

### 3.3 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

**END OF SECTION 221319**

## SECTION 224000 - PLUMBING FIXTURES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Faucets for lavatories and sinks.
  - 2. Flushometers.
  - 3. Toilet seats.
  - 4. Protective shielding guards.
  - 5. Fixture supports.
  - 6. Water closets.
  - 7. Urinals.
  - 8. Lavatories.

#### 1.2 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- C. FRP: Fiberglass-reinforced plastic.
- D. PMMA: Polymethyl methacrylate (acrylic) plastic.
- E. PVC: Polyvinyl chloride plastic.
- F. Solid Surface: Nonporous, homogeneous, cast-polymer-plastic material with heat-, impact-, scratch-, and stain-resistance qualities.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and maintenance data.

#### 1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
- C. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- D. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- E. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- F. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
  - 1. Enameled, Cast-Iron Fixtures: ASME A112.19.1M.
  - 2. Plastic Laundry Trays: ANSI Z124.6.
  - 3. Plastic Shower Enclosures: ANSI Z124.2.

4. Plastic Sinks: ANSI Z124.6.
  5. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
  6. Slip-Resistant Bathing Surfaces: ASTM F 462.
  7. Solid-Surface-Material Lavatories and Sinks: ANSI/ICPA SS-1.
  8. Stainless-Steel Residential Sinks: ASME A112.19.3.
  9. Vitreous-China Fixtures: ASME A112.19.2M.
  10. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
  11. Water-Closet, Flushometer Tank Trim: ASSE 1037.
- G. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
1. Backflow Protection Devices for Faucets with Side Spray: ASME A112.18.3M.
  2. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
  3. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
  4. Faucets: ASME A112.18.1.
  5. Hose-Connection Vacuum Breakers: ASSE 1011.
  6. Hose-Coupling Threads: ASME B1.20.7.
  7. Integral, Atmospheric Vacuum Breakers: ASSE 1001.
  8. NSF Potable-Water Materials: NSF 61.
  9. Pipe Threads: ASME B1.20.1.
  10. Sensor-Actuated Faucets and Electrical Devices: UL 1951.
  11. Supply Fittings: ASME A112.18.1.
  12. Brass Waste Fittings: ASME A112.18.2.
- H. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
1. Atmospheric Vacuum Breakers: ASSE 1001.
  2. Brass and Copper Supplies: ASME A112.18.1.
  3. Dishwasher Air-Gap Fittings: ASSE 1021.
  4. Manual-Operation Flushometers: ASSE 1037.
  5. Plastic Tubular Fittings: ASTM F 409.
  6. Brass Waste Fittings: ASME A112.18.2.
  7. Sensor-Operation Flushometers: ASSE 1037 and UL 1951.
- I. Comply with the following applicable standards and other requirements specified for miscellaneous components:
1. Disposers: ASSE 1008 and UL 430.
  2. Dishwasher Air-Gap Fittings: ASSE 1021.
  3. Flexible Water Connectors: ASME A112.18.6.
  4. Grab Bars: ASTM F 446.
  5. Hose-Coupling Threads: ASME B1.20.7.
  6. Hot-Water Dispensers: ASSE 1023 and UL 499.
  7. Off-Floor Fixture Supports: ASME A112.6.1M.
  8. Pipe Threads: ASME B1.20.1.
  9. Plastic Toilet Seats: ANSI Z124.5.
  10. Supply and Drain Protective Shielding Guards: ICC A117.1.

## PART 2 - PRODUCTS

### 2.1 LAVATORY FAUCETS

- A. Lavatory Faucets:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Standard Companies, Inc.
    - b. Bradley Corporation.
    - c. Chicago Faucets.
    - d. Delta Faucet Company.
    - e. Eljer.
    - f. Elkay Manufacturing Co.
    - g. Kohler Co.
    - h. Moen, Inc.
    - i. T & S Brass and Bronze Works, Inc.
    - j. Zurn Plumbing Products Group; Commercial Brass Operation.
    - k. Peerless.
  2. Description: See schedule on the drawings.

## 2.2 FLUSHOMETERS

### A. Flushometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Sloan Valve Company.
  - b. Zurn Plumbing Products Group; Commercial Brass Operation.
  - c. TOTO USA, Inc.
2. Description: See schedule on the drawings.

## 2.3 TOILET SEATS

### A. Toilet Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Standard Companies, Inc.
  - b. Bemis Manufacturing Company.
  - c. Centoco Manufacturing Corp.
  - d. Church Seats.
  - e. Eljer.
  - f. Kohler Co.
  - g. Olsonite Corp.
  - h. Sanderson Plumbing Products, Inc.; Beneke Div.
2. Description: Toilet seat for water-closet-type fixture.
  - a. Material: Molded, solid plastic with antimicrobial agent.
  - b. Configuration: Open front without cover.
  - c. Size: Elongated.
  - d. Hinge Type: SS, self-sustaining.
  - e. Class: Heavy-duty commercial.
  - f. Color: White.

## 2.4 PROTECTIVE SHIELDING GUARDS

### A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Engineered Brass Co.
  - b. Insul-Tect Products Co.; a Subsidiary of MVG Molded Products.
  - c. McGuire Manufacturing Co., Inc.
  - d. Plumberex Specialty Products Inc.
  - e. TCI Products.
  - f. TRUEBRO, Inc.
  - g. Zurn Plumbing Products Group; Tubular Brass Plumbing Products Operation.
2. Description: Manufactured plastic wraps for covering plumbing fixture hot-water supply and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

## 2.5 FIXTURE SUPPORTS

### A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Josam Company.
2. MIFAB Manufacturing Inc.
3. Smith, Jay R. Mfg. Co.
4. Tyler Pipe; Wade Div.
5. Watts Drainage Products Inc.; a div. of Watts Industries, Inc.
6. Zurn Plumbing Products Group; Specification Drainage Operation.

### B. Water-Closet Supports:

1. Description: Combination carrier designed for accessible or standard mounting height of wall-mounting, water-closet-type fixture. Include single or double, vertical or horizontal, hub-and-spigot or hubless waste fitting as required for piping arrangement; faceplates; couplings with gaskets; feet; and fixture bolts and hardware matching fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.

### C. Urinal Supports:

1. Description: Type I, urinal carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture for wall-mounting, urinal-type fixture. Include steel uprights with feet.

2. Accessible-Fixture Support: Include rectangular steel uprights.

D. Lavatory Supports:

1. Description: Type II, lavatory carrier with concealed arms and tie rod for wall-mounting, lavatory-type fixture. Include steel uprights with feet.
2. Accessible-Fixture Support: Include rectangular steel uprights.

2.6 WATER CLOSETS

A. Water Closets:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Standard Companies, Inc.
  - b. Crane Plumbing, L.L.C./Fiat Products.
  - c. Eljer.
  - d. Kohler Co.
  - e. Gerber.
  - f. Sloan.
2. Description: See schedule on the drawings.

2.7 URINALS

A. Urinals:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Standard Companies, Inc.
  - b. Crane Plumbing, L.L.C./Fiat Products.
  - c. Eljer.
  - d. Kohler Co.
  - e. Sloan.
2. Description: See schedule on the drawings.

2.8 LAVATORIES

A. Lavatories:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. American Standard Companies, Inc.
  - b. Eljer.
  - c. Kohler Co.
2. Description: See schedule on the drawings.
  - a. Drain Piping: NPS 1-1/4 by NPS 1-1/2 chrome-plated, cast-brass P-trap; NPS 1-1/2, 0.045-inch-thick tubular brass waste to wall; and wall escutcheon.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Assemble plumbing fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. Install off-floor supports, affixed to building substrate, for wall-mounting fixtures.
  1. Use carrier supports with waste fitting and seal for back-outlet fixtures.
  2. Use carrier supports without waste fitting for fixtures with tubular waste piping.
  3. Use chair-type carrier supports with rectangular steel uprights for accessible fixtures.
- C. Install back-outlet, wall-mounting fixtures onto waste fitting seals and attach to supports.
- D. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- E. Install wall-mounting fixtures with tubular waste piping attached to supports.
- F. Install fixtures level and plumb according to roughing-in drawings.



- G. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
- H. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- I. Install tubular waste piping on drain outlet of each fixture to be indirectly connected to drainage system.
- J. Install flushometer valves for accessible water closets and urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- K. Install toilet seats on water closets.
- L. Install water-supply flow-control fittings with specified flow rates in fixture supplies at stop valves.
- M. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- N. Install shower flow-control fittings with specified maximum flow rates in shower arms.
- O. Install traps on fixture outlets.
  - 1. Exception: Omit trap on fixtures with integral traps.
  - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- P. Install disposer in outlet of each sink indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.
- Q. Install hot-water dispensers in back top surface of sink or in countertop with spout over sink.
- R. Install escutcheons at piping wall and ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Escutcheons are specified in Section "Basic Mechanical Materials and Methods."
- S. Seal joints between fixtures and walls, floors, and countertops using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Sealants are specified in Section "Joint Sealants."

### 3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding."
- D. Connect wiring according to Division 26 Section "Conductors and Cables."

### 3.3 FIELD QUALITY CONTROL

- A. Verify that installed plumbing fixtures are categories and types specified for locations where installed.
- B. Check that plumbing fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed plumbing fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.
- E. Install fresh batteries in sensor-operated mechanisms.

3.4 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

**END OF SECTION 224000**

## SECTION 230500 - COMMON WORK RESULTS FOR HVAC

### 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. Piping materials and installation instructions common to most piping systems.
  - 2. Transition fittings.
  - 3. Dielectric fittings.
  - 4. Mechanical sleeve seals.
  - 5. Sleeves.
  - 6. Escutcheons.
  - 7. Equipment installation requirements common to equipment sections.
  - 8. Painting and finishing.
  - 9. Supports and anchorages.

#### 1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
  - 1. CPVC: Chlorinated polyvinyl chloride plastic.
  - 2. PE: Polyethylene plastic.
  - 3. PVC: Polyvinyl chloride plastic.
- G. The following are industry abbreviations for rubber materials:
  - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
  - 2. NBR: Acrylonitrile-butadiene rubber.

#### 1.4 SUBMITTALS

- A. Product Data: For the following:
  - 1. Transition fittings.
  - 2. Dielectric fittings.
  - 3. Mechanical sleeve seals.
  - 4. Escutcheons.
- B. Welding certificates.

## 1.5 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for HVAC Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

## 1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for HVAC items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

### 2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

### 2.3 JOINING MATERIALS

- A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
  - 2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

- D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- H. Solvent Cements for Joining Plastic Piping:
  - 1. CPVC Piping: ASTM F 493.
  - 2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
- I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

## 2.4 TRANSITION FITTINGS

- A. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
  - 1. Manufacturers:
    - a. Eslon Thermoplastics.
- B. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
  - 1. Manufacturers:
    - a. Thompson Plastics, Inc.
- C. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
  - 1. Manufacturers:
    - a. NIBCO INC.
    - b. NIBCO, Inc.; Chemtrol Div.

## 2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
  - 1. Manufacturers:
    - a. Capitol Manufacturing Co.
    - b. Central Plastics Company.
    - c. Eclipse, Inc.
    - d. Epco Sales, Inc.
    - e. Hart Industries, International, Inc.
    - f. Watts Industries, Inc.; Water Products Div.
    - g. Zurn Industries, Inc.; Wilkins Div.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
  - 1. Manufacturers:
    - a. Capitol Manufacturing Co.
    - b. Central Plastics Company.
    - c. Epco Sales, Inc.
    - d. Watts Industries, Inc.; Water Products Div.
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Central Plastics Company.
    - d. Pipeline Seal and Insulator, Inc.
  2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.
1. Manufacturers:
    - a. Calpico, Inc.
    - b. Lochinvar Corp.
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.
1. Manufacturers:
    - a. Perfection Corp.
    - b. Precision Plumbing Products, Inc.
    - c. Sioux Chief Manufacturing Co., Inc.
    - d. Victaulic Co. of America.

## 2.6 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
1. Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.
  2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  3. Pressure Plates: Stainless steel. Include two for each sealing element.
  4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.7 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
1. Underdeck Clamp: Clamping ring with set screws.
- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe: ASTM D 1785, Schedule 40.
- G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

## 2.8 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
  - 1. Finish: Polished chrome-plated.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
  - 1. Finish: Polished chrome-plated.
- E. One-Piece, Stamped-Steel Type: With set screw and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw, and chrome-plated finish.
- G. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

## PART 3 - EXECUTION

### 3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 23 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
  - 1. New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
    - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
    - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    - g. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
    - h. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type with concealed hinge and set screw.
    - i. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
    - j. Bare Piping in Equipment Rooms: One-piece, stamped-steel type with set screw.

- k. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
  - M. Sleeves are not required for core-drilled holes.
  - N. Permanent sleeves are not required for holes formed by removable PE sleeves.
  - O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
  - P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
    - 1. Cut sleeves to length for mounting flush with both surfaces.
      - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
    - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
    - 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
      - a. Steel Pipe Sleeves: For pipes smaller than NPS 6.
      - b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
      - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.
        - 1) Seal space outside of sleeve fittings with grout.
    - 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
  - Q. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
  - R. Verify final equipment locations for roughing-in.
  - S. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.
- 3.2 PIPING JOINT CONSTRUCTION
- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
  - B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
  - C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
  - D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
  - E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
  - F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
    - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
    - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
  - G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
  - H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.



- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
  - 3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
  - 4. PVC Nonpressure Piping: Join according to ASTM D 2855.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
  - 1. Plain-End Pipe and Fittings: Use butt fusion.
  - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

### 3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
  - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
  - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
  - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
  - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.
  - 5. Install shutoff valves on supply and return piping of equipment.

### 3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

### 3.5 PAINTING

- A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

### 3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor HVAC materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor HVAC materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

**END OF SECTION 230500**

## SECTION 230553 - HVAC SYSTEM IDENTIFICATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following mechanical identification materials and their installation:
  - 1. Equipment nameplates.
  - 2. Equipment markers.
  - 3. Equipment signs.
  - 4. Access panel and door markers.
  - 5. Duct markers.

#### 1.2 SUBMITTALS

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

#### 1.3 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

### PART 2 - PRODUCTS

#### 2.1 EQUIPMENT IDENTIFICATION DEVICES

- A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
  - 1. Data:
    - a. Manufacturer, product name, model number, and serial number.
    - b. Capacity, operating and power characteristics, and essential data.
    - c. Labels of tested compliances.
  - 2. Location: Accessible and visible.
  - 3. Fasteners: As required to mount on equipment.
- B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
  - 1. Terminology: Match schedules as closely as possible.
  - 2. Data:
    - a. Name and plan number.
    - b. Equipment service.
    - c. Design capacity.
    - d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
  - 3. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.
- C. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
  - 1. Data: Instructions for operation of equipment and for safety procedures.
  - 2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
  - 3. Thickness: 1/16 inch, unless otherwise indicated.
  - 4. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.
- D. Access Panel and Door Markers: 1/16-inch-thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.
  - 1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

### PART 3 - EXECUTION

#### 3.1 APPLICATIONS, GENERAL

- A. Products specified are for applications referenced in other Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

### 3.2 EQUIPMENT IDENTIFICATION

- A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:
1. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
  2. Pumps, compressors, chillers, condensers, and similar motor-driven units.
  3. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
  4. Fans, blowers, primary balancing dampers, and mixing boxes.
  5. Air handling equipment.
- B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.
1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
  3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:
    - a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
    - b. Meters, gages, thermometers, and similar units.
    - c. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
    - d. Pumps, compressors, chillers, condensers, and similar motor-driven units.
    - e. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
    - f. Fans, blowers, primary balancing dampers, and mixing boxes.
    - g. Packaged HVAC central-station and zone-type units.
    - h. Tanks and pressure vessels.
    - i. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.
- C. Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible.
1. Identify mechanical equipment with equipment markers in the following color codes:
    - a. Green: For cooling equipment and components.
    - b. Yellow: For heating equipment and components.
    - c. Orange: For combination cooling and heating equipment and components.
    - d. Brown: For energy-reclamation equipment and components.
  2. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  3. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
  4. Include signs for the following general categories of equipment:
    - a. Heat exchangers, coils, evaporators, heat recovery units, and similar equipment.
    - b. Fans, blowers, primary balancing dampers, and mixing boxes.
    - c. Packaged HVAC central-station and zone-type units.
- D. Install access panel markers with screws on equipment access panels.

### 3.3 ADJUSTING AND CLEANING

- A. Relocate mechanical identification materials and devices that have become visually blocked by other work.
- B. Clean faces of mechanical identification devices and glass frames of valve schedules.

**END OF SECTION 230553**

## **SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes:
  - 1. Balancing Air Systems:
    - a. Constant-volume air systems.
    - b. Variable-air-volume systems.

#### **1.2 DEFINITIONS**

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An entity engaged to perform TAB Work.

#### **1.3 ACTION SUBMITTALS**

- A. TAB Report: Documentation of work performed for ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.
- D. Certified TAB reports.
- E. Sample report forms.
- F. Instrument calibration reports, to include the following:
  - 1. Instrument type and make.
  - 2. Serial number.
  - 3. Application.
  - 4. Dates of use.
  - 5. Dates of calibration.

#### **1.5 QUALITY ASSURANCE**

- A. TAB Firm Qualifications: Engage a TAB firm certified by NEBB or AABC.
- B. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:
  - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
  - 2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.

## 1.6 PROJECT CONDITIONS

- A. Partial Owner Occupancy: Owner will occupy completed areas of building during construction. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

## 1.7 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

## 1.8 WARRANTY

- A. Special Guarantee: Provide a guarantee on NEBB or AABC forms stating that NEBB or AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee shall include the following provisions:
  - 1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
  - 2. Systems are balanced to optimum performance capabilities within design and installation limits.

## PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
  - 1. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- B. Examine approved submittal data of HVAC systems and equipment.
- C. Examine Project Record Documents described in Division 1 Section "Project Record Documents."
- D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine equipment performance data including fan and pump curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.
- F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.
- G. Examine system and equipment test reports.
- H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

- J. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- K. Examine terminal units, such as variable-air-volume boxes, to verify that they are accessible and their controls are connected and functioning.
- L. Examine strainers for clean screens and proper perforations.
- M. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- N. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- O. Examine system pumps to ensure absence of entrained air in the suction piping.
- P. Examine equipment for installation and for properly operating safety interlocks and controls.
- Q. Examine automatic temperature system components to verify the following:
  - 1. Dampers, valves, and other controlled devices are operated by the intended controller.
  - 2. Dampers and valves are in the position indicated by the controller.
  - 3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
  - 4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
  - 5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
  - 6. Sensors are located to sense only the intended conditions.
  - 7. Sequence of operation for control modes is according to the Contract Documents.
  - 8. Controller set points are set at indicated values.
  - 9. Interlocked systems are operating.
  - 10. Changeover from heating to cooling mode occurs according to indicated values.
- R. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

### 3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system readiness checks and prepare system readiness reports. Verify the following:
  - 1. Permanent electrical power wiring is complete.
  - 2. Hydronic systems are filled, clean, and free of air.
  - 3. Automatic temperature-control systems are operational.
  - 4. Equipment and duct access doors are securely closed.
  - 5. Balance, smoke, and fire dampers are open.
  - 6. Isolating and balancing valves are open and control valves are operational.
  - 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
  - 8. Windows and doors can be closed so indicated conditions for system operations can be met.

### 3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" or AABC's "National standards for Total System Balance" and this Section.
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.
- C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

### 3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- E. Check airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling unit components.
- L. Check for proper sealing of air duct system.

### 3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
  - 1. Measure total airflow.
    - a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
  - 2. Measure fan static pressures as follows to determine actual static pressure:
    - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
    - b. Measure static pressure directly at the fan outlet or through the flexible connection.
    - c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
    - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
  - 3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
    - a. Report the cleanliness status of filters and the time static pressures are measured.
  - 4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
  - 5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
  - 6. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
  - 7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
  - 1. Measure airflow of submain and branch ducts.
    - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.



2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
  3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.
1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
  2. Adjust patterns of adjustable outlets for proper distribution without drafts.

### 3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

- A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow with the remainder at maximum airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.
- B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
1. Set outdoor-air dampers at minimum, and set return- and exhaust-air dampers at a position that simulates full-cooling load.
  2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
  3. Measure total system airflow. Adjust to within indicated airflow.
  4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
  5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.
    - a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.
  6. Remeasure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
    - a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.
  7. Measure static pressure at the most critical terminal unit and adjust the static-pressure controller at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit.
  8. Record final fan-performance data.

### 3.7 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
1. Manufacturer, model, and serial numbers.
  2. Motor horsepower rating.
  3. Motor rpm.
  4. Efficiency rating.
  5. Nameplate and measured voltage, each phase.
  6. Nameplate and measured amperage, each phase.
  7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

### 3.8 PROCEDURES FOR TEMPERATURE MEASUREMENTS

- A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.
- B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.
- C. Measure outside-air, wet- and dry-bulb temperatures.

### 3.9 TEMPERATURE-CONTROL VERIFICATION

- A. Verify that controllers are calibrated and commissioned.
- B. Check transmitter and controller locations and note conditions that would adversely affect control functions.
- C. Record controller settings and note variances between set points and actual measurements.
- D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).
- E. Check free travel and proper operation of control devices such as damper and valve operators.
- F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.
- G. Check the interaction of electrically operated switch transducers.
- H. Check the interaction of interlock and lockout systems.
- I. Check main control supply-air pressure and observe compressor and dryer operations.
- J. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.
- K. Note operation of electric actuators using spring return for proper fail-safe operations.

### 3.10 TOLERANCES

- A. Set HVAC system airflow and water flow rates within the following tolerances:
  - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: 0 to plus 5 percent.
  - 2. Air Outlets and Inlets: 0 to plus 10 percent.
  - 3. Cooling-Water Flow Rate: 0 to plus 10 percent.

### 3.11 FINAL REPORT

- A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.
- B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
  - 1. Include a list of instruments used for procedures, along with proof of calibration.
- C. Final Report Contents: In addition to certified field report data, include the following:
  - 1. Pump curves.
  - 2. Fan curves.
  - 3. Manufacturers' test data.
  - 4. Field test reports prepared by system and equipment installers.
  - 5. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.

- D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:
1. Title page.
  2. Name and address of TAB firm.
  3. Project name.
  4. Project location.
  5. Architect's name and address.
  6. Engineer's name and address.
  7. Contractor's name and address.
  8. Report date.
  9. Signature of TAB firm who certifies the report.
  10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
  11. Summary of contents including the following:
    - a. Indicated versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.
  12. Nomenclature sheets for each item of equipment.
  13. Data for terminal units, including manufacturer, type size, and fittings.
  14. Notes to explain why certain final data in the body of reports varies from indicated values.
  15. Test conditions for fans and pump performance forms including the following:
    - a. Settings for outside-, return-, and exhaust-air dampers.
    - b. Conditions of filters.
    - c. Cooling coil, wet- and dry-bulb conditions.
    - d. Face and bypass damper settings at coils.
    - e. Fan drive settings including settings and percentage of maximum pitch diameter.
    - f. Inlet vane settings for variable-air-volume systems.
    - g. Settings for supply-air, static-pressure controller.
    - h. Other system operating conditions that affect performance.
- E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outside, supply, return, and exhaust airflows.
  2. Water and steam flow rates.
  3. Duct, outlet, and inlet sizes.
  4. Pipe and valve sizes and locations.
  5. Terminal units.
  6. Balancing stations.
  7. Position of balancing devices.

### 3.12 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near-peak summer and winter conditions.

### END OF SECTION 230593



## **SECTION 230713 - DUCT 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 insulating the following duct services:
  - 1. Low and medium pressure supply.
  - 2. Outdoor air.
  - 3. Relief air.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets or covering.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail application of protective shields and inserts at hangers for each type of insulation and hanger.
  - 2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
  - 3. Detail application at linkages of control devices.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For qualified Installer.

#### **1.5 QUALITY ASSURANCE**

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

#### **1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

#### **1.7 COORDINATION**

- A. Coordinate sizes and locations of supports, hangers, and insulation shields.
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

#### **1.8 SCHEDULING**

- A. Schedule insulation application after any required ductwork pressure testing is complete. Insulation application may begin on segments that have satisfactory test results.

## PART 2 - PRODUCTS

### 2.1 INSULATION MATERIALS

- A. Comply with requirements in Duct Insulation Schedule for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. CertainTeed Corp.; SoftTouch Duct Wrap.
    - b. Johns Manville; Microlite.
    - c. Knauf Insulation; Friendly Feel Duct Wrap.
    - d. Owens Corning; SOFTR All-Service Duct Wrap.
- E. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. CertainTeed Corp.; Commercial Board.
    - b. Johns Manville; 800 Series Spin-Glas.
    - c. Knauf Insulation; Insulation Board.
    - d. Owens Corning; Fiberglas 700 Series.

### 2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand; CP-127.
    - b. Eagle Bridges; 225.
    - c. Foster Brand; 85-60/85-70.
    - d. Mon-Eco Industries, Inc.; 22-25.
  - 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand; CP-82.
    - b. Eagle Bridges; 225.
    - c. Foster Brand; 85-50.
    - d. Mon-Eco Industries, Inc.; 22-25.
  - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
  - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
  - 1. Subject to compliance with requirements, provide one of the following:
    - a. Foster Brand; 30-80/30-90.
    - b. Vimasco Corporation; 749.
  - 2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
  - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
  - 4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
  - 5. Color: White.

## 2.4 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
  - 1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand; CP-50 AHV2.
    - b. Foster Brand; 30-36.
    - c. Vimasco Corporation; 713 and 714.
  - 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
  - 4. Service Temperature Range: 0 to plus 180 deg F.
  - 5. Color: White.

## 2.5 SEALANTS

- A. FSK Sealants:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand; CP-76.
    - b. Eagle Bridges; 405.
    - c. Foster Brand; 95-44.
    - d. Mon-Eco Industries, Inc.; 44-05.
  - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 3. Fire- and water-resistant, flexible, elastomeric sealant.
  - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
  - 5. Color: Aluminum.
  - 6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.6 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
  - 1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

## 2.7 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

## 2.8 TAPES

- A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. ABI; 491 AWF FSK.
    - b. Avery Dennison Corporation; Fasson 0827.
    - c. Compac Corporation; 110 and 111.
    - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
  - 2. Width: 3 inches.
  - 3. Thickness: 6.5 mils.
  - 4. Adhesion: 90 ounces force/inch in width.
  - 5. Elongation: 2 percent.
  - 6. Tensile Strength: 40 lbf/inch in width.
  - 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

## 2.9 SECUREMENTS

- A. Insulation Pins and Hangers:
  - 1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  - 1. Verify that systems to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Keep insulation materials dry during application and finishing.
- E. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- F. Install insulation with least number of joints practical.
- G. Where vapor barrier is indicated, seal joints, seams, and penetrations. No penetration in insulation is permitted at hangers, supports, and other projections.
  - 1. Install insulation continuously through hangers and supports.



2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- H. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- I. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
  2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive.
  3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive sealing tape.
  4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- J. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- K. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- L. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

### 3.4 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
1. Firestopping materials and fire-resistive joint sealers applicable for the installation.
- C. Insulation Installation at Floor Penetrations:
1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
  2. Seal penetrations through fire-rated assemblies.

### 3.5 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Blanket or Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
  2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  3. Install capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides or bottom with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides or bottom with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not overcompress insulation during installation.
    - e. Impale insulation over pins and attach speed washers.
    - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  4. For ducts and plenums, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation

segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

- a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
  - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
  6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

### 3.6 FIELD QUALITY CONTROL

- A. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

### 3.7 DUCT INSULATION SCHEDULE

- A. Refer to ductwork insulation schedule on drawings.
- B. Items Not Insulated:
  1. Factory-insulated flexible ducts.
  2. Factory-insulated plenums and casings.
  3. Flexible connectors.
  4. Vibration-control devices.
  5. Factory-insulated access panels and doors.

### END OF SECTION 230713

## **SECTION 233113 - METAL DUCTS**

### **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. Single-wall rectangular ducts and fittings.
  - 2. Single-wall round ducts and fittings.
  - 3. Double-wall round ducts and fittings.
  - 4. Sheet metal materials.
  - 5. Duct liner.
  - 6. Sealants and gaskets.
  - 7. Hangers and supports.
- B. Related Sections:
  - 1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
  - 2. Section 233300 "Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

#### **1.3 PERFORMANCE REQUIREMENTS**

- A. Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of the following products:
  - 1. Liners and adhesives.
  - 2. Sealants and gaskets.
- B. Shop Drawings:
  - 1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
  - 2. Factory- and shop-fabricated ducts and fittings.
  - 3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
  - 4. Elevation of top of ducts.
  - 5. Dimensions of main duct runs from building grid lines.
  - 6. Fittings.
  - 7. Reinforcement and spacing.
  - 8. Seam and joint construction.
  - 9. Penetrations through fire-rated and other partitions.
  - 10. Equipment installation based on equipment being used on Project.
  - 11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
  - 12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: 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. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
  - 2. Suspended ceiling components.
  - 3. Structural members to which duct will be attached.
  - 4. Size and location of initial access modules for acoustical tile.
  - 5. Penetrations of smoke barriers and fire-rated construction.
  - 6. Items penetrating finished ceiling including the following:
    - a. Luminaires.
    - b. Air outlets and inlets.
    - c. Speakers.
    - d. Sprinklers.
    - e. Access panels.
    - f. Perimeter moldings.
- B. Welding certificates.
- C. Field quality-control reports.

## 1.6 QUALITY ASSURANCE

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."
- B. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

## PART 2 - PRODUCTS

### 2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

### 2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## 2.3 DOUBLE-WALL ROUND DUCTS AND FITTINGS

A. Round Ducts: Indicated dimensions are the duct diameter of the inner duct.

B. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.

1. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - a. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
2. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - a. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
  - b. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
3. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Inner Duct: Minimum 0.028-inch perforated galvanized sheet steel having 3/32-inch-diameter perforations, with overall open area of 23 percent.

D. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
3. Coat insulation with antimicrobial coating.
4. Cover insulation with polyester film complying with UL 181, Class 1.

## 2.4 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

## 2.5 DUCT LINER

- A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
  - 1. Maximum Thermal Conductivity:
    - a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
    - b. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
  - 2. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
  - 3. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
- B. Insulation Pins and Washers:
  - 1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch-diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
  - 2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."
  - 1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
  - 2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
  - 3. Butt transverse joints without gaps, and coat joint with adhesive.
  - 4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
  - 5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
  - 6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
  - 7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
  - 8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
    - a. Fan discharges.
    - b. Intervals of lined duct preceding unlined duct.
    - c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.
  - 9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
    - a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.
  - 10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

## 2.6 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Water-Based Joint and Seam Sealant:
  - 1. Application Method: Brush on.
  - 2. Solids Content: Minimum 65 percent.
  - 3. Shore A Hardness: Minimum 20.
  - 4. Water resistant.
  - 5. Mold and mildew resistant.
  - 6. VOC: Maximum 75 g/L (less water).
  - 7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
  - 8. Service: Indoor or outdoor.
  - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

- C. Flanged Joint Sealant: Comply with ASTM C 920.
  - 1. General: Single-component, acid-curing, silicone, elastomeric.
  - 2. Type: S.
  - 3. Grade: NS.
  - 4. Class: 25.
  - 5. Use: O.
- D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- E. Round Duct Joint O-Ring Seals:
  - 1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
  - 2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
  - 3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

## 2.7 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. Trapeze and Riser Supports:
  - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
  - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
  - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

## PART 3 - EXECUTION

### 3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

### 3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead.
- C. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- D. Repair or replace damaged sections and finished work that does not comply with these requirements.

### 3.3 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- B. Seal ducts at a minimum to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
  - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 2. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
  - 3. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
  - 4. Unconditioned Space, Exhaust Ducts: Seal Class C.
  - 5. Unconditioned Space, Return-Air Ducts: Seal Class B.
  - 6. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
  - 7. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
  - 8. Conditioned Space, Exhaust Ducts: Seal Class B.
  - 9. Conditioned Space, Return-Air Ducts: Seal Class C.

### 3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
  - 1. Where practical, install concrete inserts before placing concrete.
  - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
  - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
  - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
  - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.



- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

### 3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

### 3.6 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

### 3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:
  1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
  2. Test the following systems:
    - a. Ducts with a Pressure Class Higher Than 3-Inch wg: Test representative duct sections totaling no less than 25 percent of total installed duct area for each designated pressure class.
    - b. Supply Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 25 percent of total installed duct area for each designated pressure class.
    - c. Return Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 25 percent of total installed duct area for each designated pressure class.
    - d. Exhaust Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 25 percent of total installed duct area for each designated pressure class.
    - e. Outdoor Air Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections totaling no less than 25 percent of total installed duct area for each designated pressure class.
  3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
  4. Test for leaks before applying external insulation.
  5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
  6. Give seven days' advance notice for testing.
- C. Duct System Cleanliness Tests:
  1. Visually inspect duct system to ensure that no visible contaminants are present.
  2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
    - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
- D. Duct system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

### 3.8 START UP

- A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

### 3.9 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated.

B. Refer to Ductwork Schedule on Drawings.

**END OF SECTION 233113**

## SECTION 233300 - DUCT ACCESSORIES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Backdraft dampers.
  - 2. Volume dampers.
  - 3. Fire dampers.
  - 4. Smoke dampers.
  - 5. Combination fire and smoke dampers.
  - 6. Turning vanes.
  - 7. Duct-mounting access doors.
  - 8. Flexible connectors.
  - 9. Flexible ducts.
  - 10. Duct accessory hardware.
  - 11. Duct silencers.
- B. See "Fire Alarm" for duct-mounting fire and smoke detectors.
- C. See Division 23 Section "HVAC Instrumentation and Controls" for electric and pneumatic damper actuators.

#### 1.2 SUBMITTALS

- A. Product Data: For the following:
  - 1. Backdraft dampers.
  - 2. Volume dampers.
  - 3. Fire dampers.
  - 4. Ceiling fire dampers.
  - 5. Smoke dampers.
  - 6. Combination fire and smoke dampers.
  - 7. Turning vanes.
  - 8. Duct-mounting access doors.
  - 9. Flexible connectors.
  - 10. Flexible ducts.
  - 11. Duct Silencers.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Special fittings.
  - 2. Manual-volume damper installations.
  - 3. Fire-damper, smoke-damper, and combination fire- and smoke-damper installations, including sleeves and duct-mounting access doors.
  - 4. Wiring Diagrams: Power, signal, and control wiring.

#### 1.3 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

## 2.2 SHEET METAL MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
- C. Stainless Steel: ASTM A 480/A 480M.
- D. Aluminum Sheets: ASTM B 209, alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- E. Extruded Aluminum: ASTM B 221, alloy 6063, temper T6.
- F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

## 2.3 BACKDRAFT DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Air Balance, Inc.
  - 2. American Warming and Ventilating.
  - 3. CESCO Products.
  - 4. Duro Dyne Corp.
  - 5. Greenheck.
  - 6. Penn Ventilation Company, Inc.
  - 7. Prefco Products, Inc.
  - 8. Ruskin Company.
  - 9. Vent Products Company, Inc.
  - 10. Pottorff.
  - 11. Pre-approved equal.
- B. Description: Multiple-blade, parallel action gravity balanced, with center-pivoted blades of maximum 6-inch width, with sealed edges, assembled in rattle-free manner with 90-degree stop, steel ball bearings, and axles; adjustment device to permit setting for varying differential static pressure.
- C. Frame: 0.052-inch-thick, galvanized sheet steel, with welded corners and mounting flange.
- D. Blades: 0.050-inch-thick aluminum sheet.
- E. Blade Seals: Neoprene.
- F. Blade Axles: Galvanized steel.
- G. Tie Bars and Brackets: Galvanized steel.
- H. Return Spring: Adjustable tension.

## 2.4 VOLUME DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Air Balance, Inc.
  - 2. American Warming and Ventilating.
  - 3. Flexmaster U.S.A., Inc.
  - 4. McGill AirFlow Corporation.
  - 5. METALAIR, Inc.
  - 6. Nailor Industries Inc.

7. Penn Ventilation Company, Inc.
8. Ruskin Company.
9. Vent Products Company, Inc.
10. Greenheck Fan Corporation
11. Pottorff.
12. Pre-approved equal.

- B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
- C. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.
1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
  2. Roll-Formed Steel Blades: 0.064-inch-thick, galvanized sheet steel.
  3. Blade Axles: Galvanized steel.
  4. Bearings: Oil-impregnated bronze.
  5. Tie Bars and Brackets: Galvanized steel.
- D. Jackshaft: 1-inch-diameter, galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
1. Length and Number of Mountings: Appropriate to connect linkage of each damper in multiple-damper assembly.
- E. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

## 2.5 FIRE DAMPERS

- A. Manufacturers:
1. Air Balance, Inc.
  2. CESCO Products.
  3. Greenheck.
  4. McGill AirFlow Corporation.
  5. METALAIR, Inc.
  6. Nailor Industries Inc.
  7. Penn Ventilation Company, Inc.
  8. Prefco Products, Inc.
  9. Ruskin Company.
  10. Vent Products Company, Inc.
  11. Ward Industries, Inc.
  12. Pottorff.
  13. Pre-approved equal.
- B. Fire dampers shall be labeled according to UL 555.
- C. Fire Rating: 1-1/2 hours for dampers in walls rated 2-hours or less. 3 hour rating for dampers in walls rated greater than 2-hours.
- D. Frame: Low pressure applications (2" wg and less): curtain type with blades inside airstream; for ductwork constructed in higher pressure applications (above 2" wg): curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.
- E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
1. Minimum Thickness: 0.138 inch thick and of length to suit application.
  2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.
- F. Mounting Orientation: Vertical or horizontal as indicated.

- G. Blades: Roll-formed, interlocking, 0.034-inch-thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch-thick, galvanized-steel blade connectors.
- H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- I. Fusible Links: Replaceable, 165 deg F rated.

## 2.6 SMOKE OR COMBINATION FIRE AND SMOKE DAMPERS

- A. Manufacturers:
  1. Air Balance, Inc.
  2. CESCO Products.
  3. Greenheck.
  4. Nailor Industries Inc.
  5. Penn Ventilation Company, Inc.
  6. Ruskin Company.
  7. Pottorff.
  8. Pre-approved equal
- B. General Description: Labeled according to UL 555S. Combination fire and smoke dampers shall be labeled according to UL 555 for 1-1/2-hour rating.
- C. Fusible Links: Replaceable, 165 deg F rated.
- D. Frame and Blades: 0.064-inch-thick, galvanized sheet steel.
- E. Mounting Sleeve: Factory-installed, 0.052-inch-thick, galvanized sheet steel; length to suit wall or floor application.
- F. Damper Motors: Modulating and two-position action.
  1. Motors: With oil-immersed and sealed gear trains.
  2. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
  3. Outdoor Motors and Motors in Outside-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
  4. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
  5. Electrical Connection: 115 V, single phase, 60 Hz.

## 2.7 TURNING VANES

- A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.
- B. Manufactured Turning Vanes: Fabricate 1-1/2-inch-wide, double-vane, curved blades of galvanized sheet steel set 3/4 inch o.c.; support with bars perpendicular to blades set 2 inches o.c.; and set into vane runners suitable for duct mounting.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Ductmate Industries, Inc.
    - b. Duro Dyne Corp.
    - c. METALAIRE, Inc.
    - d. Ward Industries, Inc.
    - e. Pre-approved equal.
- C. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- D. Turning vanes to be provided at all elbows of all angles, with and without acoustic duct lining.

## 2.8 DUCT-MOUNTING ACCESS DOORS

- A. General Description: Fabricate doors airtight and suitable for duct pressure class.

- B. Door: Double wall, duct mounting, and rectangular; fabricated of galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch butt or piano hinge and cam latches.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. American Warming and Ventilating.
    - b. CESCO Products.
    - c. Ductmate Industries, Inc.
    - d. Flexmaster U.S.A., Inc.
    - e. Greenheck.
    - f. McGill AirFlow Corporation.
    - g. Nailor Industries Inc.
    - h. Ventfabrics, Inc.
    - i. Ward Industries, Inc.
    - j. Elgen Manufacturing
    - k. Pre-approved equal.
  2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
  3. Provide number of hinges and locks as follows:
    - a. Less Than 12 Inches Square: Secure with two sash locks.
    - b. Up to 18 Inches Square: Two hinges and two sash locks.
    - c. Up to 24 by 48 Inches: Three hinges and two compression latches.
    - d. Sizes 24 by 48 Inches and Larger: One additional hinge.
- C. Door: Double wall, duct mounting, and round; fabricated of galvanized sheet metal with insulation fill and 1-inch thickness. Include cam latches.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Ductmate Industries, Inc.
    - b. Flexmaster U.S.A., Inc.
    - c. Pre-approved equal.
  2. Frame: Galvanized sheet steel, with spin-in notched frame.
- D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.
- E. Insulation: 1-inch-thick, fibrous-glass or polystyrene-foam board.

## 2.9 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ductmate Industries, Inc.
  2. Duro Dyne Corp.
  3. Ventfabrics, Inc.
  4. Ward Industries, Inc.
  5. Pre-approved equal.
- B. General Description: Flame-retardant or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.
- C. Flexible Connector Fabric: Glass fabric double coated with neoprene.
1. Minimum Weight: 26 oz./sq. yd.
  2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
  3. Service Temperature: Minus 40 to plus 200 deg F.

## 2.10 FLEXIBLE DUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Flexmaster U.S.A., Inc.
  2. Thermaflex.
  3. McGill AirFlow Corporation.
  4. Pre-approved equal.
- B. Insulated-Duct Connectors: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor barrier film.
1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
  2. Maximum Air Velocity: 4000 fpm.

3. Temperature Range: Minus 10 to plus 160 deg F.

- C. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 through 18 inches to suit duct size.

## 2.11 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

## 2.12 DUCT SILENCERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Industrial Acoustics Company.
  2. Vibroacoustics.
  3. Price Industries.
- B. General Requirements:
1. Furnish and install "Quiet-Duct" (rectangular) silencers of the types and sizes shown on the plans and/or listed in the schedule. Silencers shall be the product of Industrial Acoustics Company. Any specification change must be submitted in writing and approved by the Architect/Engineer, in writing, at least 10 days prior to the bid due-date.
- C. Materials:
1. Outer casings of rectangular silencers shall be made of 22 gauge type #G-90 lock-former-quality galvanized steel unless otherwise noted on schedule.
  2. Interior partitions for rectangular silencers shall be not less than 26 gauge type #G-90 galvanized lock-former-quality perforated steel.
  3. Filler material shall be inorganic glass fiber of a proper density to obtain the specified acoustic performance and be packed under not less than 5% compression to eliminate voids due to vibration and settling. Material shall be inert, vermin- and moisture-proof.
  4. Combustion ratings for the silencer acoustic fill shall be not greater than the following when tested to ASTM E 84, NFPA Standard 255, or UL No. 723:
    - a. Flamespread Classification: 20.
    - b. Smoke Development Rating: 20.
- D. Construction:
1. Units shall be constructed in accordance with the ASHRAE Guide recommendations for high pressure duct work. Seams shall be lock formed and mastic filled. Rectangular casing seams shall be in the corners of the silencer shell to provide maximum unit strength and rigidity. Interior partitions shall be fabricated from single-piece, margin-perforated sheets and shall have die-formed entrance and exit shapes so as to provide the maximum aerodynamic efficiency and minimum self-noise characteristics in the sound attenuator. Blunt noses or squared off partitions will not be accepted.
  2. Attachment of the interior partitions to the casing shall be by means of an interlocking track assembly. Tracks shall be solid galvanized steel and shall be welded to the outer casing. Attachment of the interior partitions to the tracks shall be such that a minimum of 4 thicknesses of metal exist at this location. The track assembly shall stiffen the exterior casing, provide a reinforced attachment detail for the interior partitions, and shall maintain a uniform airspace width along the length of the silencer for consistent aerodynamic and acoustic performance. Interior partitions shall be additionally secured to the outer casing with welded nose clips at both ends of the sound attenuator.
  3. Sound attenuating units shall not fail structurally when subjected to a differential air pressure of 8 inches water gauge from inside to outside the casing. Airtight construction shall be provided by use of a duct sealing compound on the job-site material and labor furnished by the contractor.
- E. Acoustic Performance:
1. All silencer ratings shall be determined in a duct-to-reverberant room test facility which provides for airflow in both directions through the test silencer in accordance with ASTM Specification E477-99. The test facility shall be NVLAP accredited for the ASTM E477-99 test standard. Data from a non-accredited laboratory will not be acceptable. The test set-up and procedure shall be such that all effects due to end reflection, directivity, flanking transmission, standing waves and test chamber sound absorption are eliminated.



Acoustic ratings shall include Dynamic Insertion Loss (DIL) and Self-Noise (SN) Power Levels both for FORWARD FLOW (air and noise in same direction) and REVERSE FLOW (air and noise in opposite directions) with airflow of at least 2000 fpm entering face velocity. Data for rectangular and tubular type silencers shall be presented for tests conducted using silencers no smaller than the following cross-sections:

- a. Rectangular, inch: 24x24, 24x30, or 24x36.
- b. Tubular, inch: 12, 24, 36, and 48.

- F. Aerodynamic Performance:
1. Static pressure loss of silencers shall not exceed 0.05" wg. Airflow measurements shall be made in accordance with ASTM specification E477-99 and applicable portions of ASME, AMCA, and ADC airflow test codes. Tests shall be reported on the identical units for which acoustic data is presented.
- G. Certification:
1. With submittals, the manufacturer shall supply certified test data on Dynamic Insertion Loss, Self-Noise Power Levels, and Aerodynamic Performance for Reverse and Forward Flow test conditions. Test data shall be for a standard product. All rating tests shall be conducted in the same facility, shall utilize the same silencer, and shall be open to inspection upon request from the Architect/Engineer.
- H. Duct Transitions:
1. When transitions are required to adapt silencer dimensions to connecting duct work they shall be furnished by the installing contractor.

### PART 3 - EXECUTION

#### 3.1 APPLICATION AND INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Provide duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- D. Install volume dampers in ducts with liner; avoid damage to and erosion of duct liner.
- E. Provide balancing dampers at points on supply, return, and exhaust systems where branches lead from larger ducts as required for air balancing. Install at a minimum of two duct widths from branch takeoff.
- F. Provide test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire and smoke dampers, with fusible links, according to manufacturer's UL-approved written instructions.
- H. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows:
1. On both sides of duct coils.
  2. Downstream from volume dampers and equipment.
  3. Adjacent to fire or smoke dampers, providing access to reset or reinstall fusible links.
  4. To interior of ducts for cleaning; before and after each change in direction, at maximum 50-foot spacing.
  5. On sides of ducts where adequate clearance is available.
- I. Install the following sizes for duct-mounting, rectangular access doors:
1. One-Hand or Inspection Access: 8 by 5 inches.
  2. Two-Hand Access: 12 by 6 inches.
  3. Head and Hand Access: 18 by 10 inches.
  4. Head and Shoulders Access: 21 by 14 inches.
  5. Body Access: 25 by 14 inches.
  6. Body Plus Ladder Access: 25 by 17 inches.
- J. Install the following sizes for duct-mounting, round access doors:

1. One-Hand or Inspection Access: 8 inches in diameter.
2. Two-Hand Access: 10 inches in diameter.
3. Head and Hand Access: 12 inches in diameter.
4. Head and Shoulders Access: 18 inches in diameter.
5. Body Access: 24 inches in diameter.

K. Label access doors according to Division 23 Section "HVAC System Identification."

L. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.

M. Connect diffusers or light troffer boots to low pressure ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place.

N. Connect flexible ducts to metal ducts with draw bands.

O. Install duct test holes where indicated and required for testing and balancing purposes.

### 3.2 ADJUSTING

A. Adjust duct accessories for proper settings.

B. Adjust fire and smoke dampers for proper action.

C. Final positioning of manual-volume dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing."

**END OF SECTION 233300**

## **SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes ceiling, wall and floor-mounted diffusers, registers, and grilles.

#### **1.2 SUBMITTALS**

- A. Product Data: For each product indicated, include the following:
  - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
  - 2. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.

### **PART 2 - PRODUCTS**

#### **2.1 MANUFACTURERS**

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

#### **2.2 GRILLES, DIFFUSERS AND REGISTERS**

- A. See schedule on the drawings.
  - 1. Manufacturers:
    - a. Krueger.
    - b. Nailor Industries of Texas Inc.
    - c. Price Industries.
    - d. Titus.
    - e. Architectural Grille (Tag: LBG-1 only)

#### **2.3 SOURCE QUALITY CONTROL**

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers.

#### **3.2 ADJUSTING**

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

### **END OF SECTION 233713**



## SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes:
  - 1. Sleeves for raceways and cables.
  - 2. Sleeve seals.
  - 3. Grout.
  - 4. Common electrical installation requirements.

#### 1.2 SUBMITTALS

- A. Product Data: For sleeve seals.

### PART 2 - PRODUCTS

#### 2.1 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel.
  - 1. Minimum Metal Thickness:
    - a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
    - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

#### 2.2 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.
  - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
  - 3. Pressure Plates: Plastic. Include two for each sealing element.
  - 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

#### 2.3 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

### PART 3 - EXECUTION

#### 3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

### 3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
  - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

### 3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### 3.4 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly.

**END OF SECTION 260500**





## **SECTION 260519 - CONDUCTORS AND CABLES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Building wires and cables rated 600 V and less.
  - 2. Connectors, splices, and terminations rated 600 V and less.
  - 3. Sleeves and sleeve seals for cables.

#### **1.2 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.

#### **1.3 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

### **PART 2 - PRODUCTS**

#### **2.1 CONDUCTORS AND CABLES**

- A. Aluminum and Copper Conductors: Comply with NEMA WC 70.
- B. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.
- C. Metal-clad Cable, Type MC:
  - 1. Type MC cable shall be U.L. listed. MC cable materials, marking, installation methods and permitted usage shall comply with Article 334 of the N.E.C. and with these specifications.
  - 2. All type MC cables shall contain conductors suitable for the application.
  - 3. All type MC cables shall contain a separate insulated green grounding conductor along with the current carrying conductors sized in accordance with the NEC.

#### **2.2 CONNECTORS AND SPLICES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AFC Cable Systems, Inc.
  - 2. Hubbell Power Systems, Inc.
  - 3. O-Z/Gedney; EGS Electrical Group LLC.
  - 4. 3M; Electrical Products Division.
  - 5. Tyco Electronics Corp.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

#### **2.3 SLEEVES FOR CABLES**

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

## 2.4 SLEEVE SEALS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Advance Products & Systems, Inc.
  - 2. Calpico, Inc.
  - 3. Metraflex Co.
  - 4. Pipeline Seal and Insulator, Inc.
- B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
  - 1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
  - 2. Pressure Plates: Plastic. Include two for each sealing element.
  - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## PART 3 - EXECUTION

### 3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper for feeders smaller than No. 1 AWG; copper or 8000 series aluminum alloy for feeders No. 1 AWG and larger. (Use of aluminum alloy conductors on feeders shall be submitted as a bid alternate). Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

### 3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN-THWN, single conductors in raceway.
- B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway.
- C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- D. Branch Circuits Concealed in Ceilings, Walls, and Partitions:
  - 1. Type THHN-THWN, single conductors in raceway or metal-clad cable, type MC.
    - a. Type MC cable may be used in lieu of single conductors in raceway only for branch circuits (with up to four conductors not including ground conductor) and only in dry concealed locations above grade except where specifically not permitted by the NEC or this specification.
    - b. Type MC cable shall **not** be permitted for the following uses:
      - 1) Concealed within walls and partitions (MC cable allowed only above ceilings).
      - 2) Connections to panelboards (MC cable can terminate in a wireway gutter located above the panel, and above the accessible ceiling).
      - 3) Where exposed to view.
      - 4) Where exposed to damage.
      - 5) Hazardous locations.
      - 6) Wet locations.
    - c. UL listed connectors with insulated bushings and offset screw connections shall be utilized for MC cable installations.
    - d. Type MC cable shall be supported and secured within twelve (12) inches of every outlet box or fitting.
    - e. Type MC cable whips may be utilized in lieu of flexible conduit and wire for wiring from light fixtures in accessible ceilings to junction boxes above ceiling. Cable whip lengths shall be sufficient to allow for relocating each light fixture within a five (5) foot radius of its installed location.
- E. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- F. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

G. Class 1 Control Circuits: Type THHN-THWN, in raceway.

H. Class 2 Control Circuits: Type THHN-THWN, in raceway.

### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

E. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

F. Support and secure type MC cable within twelve (12) inches of every outlet box or fitting.

G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

H. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

I. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

### END OF SECTION 260519



## **SECTION 260523 - CONTROL-VOLTAGE ELECTRICAL POWER CABLES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. UTP cabling.
  - 2. RS-232 cabling.
  - 3. RS-485 cabling.
  - 4. Low-voltage control cabling.
  - 5. Control-circuit conductors.
  - 6. Identification products.

#### **1.2 DEFINITIONS**

- A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.

#### **1.3 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Field quality-control reports.
- C. Maintenance data.

#### **1.4 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: Member company of an NRTL.
- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 450 or less.
- C. 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.

#### **1.5 DELIVERY, STORAGE, AND HANDLING**

- A. Test cables upon receipt at Project site.
- B. Test each pair of UTP cable for open and short circuits.

### **PART 2 - PRODUCTS**

#### **2.1 PATHWAYS**

- A. Support of Open Cabling: NRTL labeled for support of cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
  - 1. Support brackets with cable tie slots for fastening cable ties to brackets.
  - 2. Lacing bars, spools, J-hooks, and D-rings.
  - 3. Straps and other devices.
- B. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.
  - 1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

## 2.2 LOW-VOLTAGE CONTROL CABLE

- A. Paired Cable: NFPA 70, Type CMG.
  - 1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
  - 2. PVC insulation.
  - 3. Unshielded.
  - 4. PVC jacket.
  - 5. Flame Resistance: Comply with UL 1581.
- B. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
  - 1. One pair, twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors.
  - 2. PVC insulation.
  - 3. Unshielded.
  - 4. PVC jacket.
  - 5. Flame Resistance: Comply with NFPA 262.
- C. Paired Cable: NFPA 70, Type CMG.
  - 1. One pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors.
  - 2. PVC insulation.
  - 3. Unshielded.
  - 4. PVC jacket.
  - 5. Flame Resistance: Comply with UL 1581.
- D. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
  - 1. One pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors.
  - 2. Fluorinated ethylene propylene insulation.
  - 3. Unshielded.
  - 4. Plastic jacket.
  - 5. Flame Resistance: NFPA 262, Flame Test.

## 2.3 CONTROL-CIRCUIT CONDUCTORS

- A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway, complying with UL 83.
- B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway, complying with UL 83.
- C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or Type TF, complying with UL 83.

## 2.4 IDENTIFICATION PRODUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Brady Corporation.
  - 2. HellermannTyton.
  - 3. Kroy LLC.
  - 4. Panduit Corp.
- B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- C. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF PATHWAYS

- A. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
- B. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.

### 3.2 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1.
- B. Installation of Control-Circuit Conductors:
  - 1. Install wiring in raceways. Comply with requirements specified in Division 26 Section "Raceway and Boxes for Electrical Systems."
- C. Open-Cable Installation:
  - 1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
  - 2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
  - 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

### 3.3 REMOVAL OF CONDUCTORS AND CABLES

- A. Remove abandoned conductors and cables.

### 3.4 CONTROL-CIRCUIT CONDUCTORS

- A. Minimum Conductor Sizes:
  - 1. Class 1 remote-control and signal circuits, No 14 AWG.
  - 2. Class 2 low-energy, remote-control, and signal circuits, No. 16 AWG.
  - 3. Class 3 low-energy, remote-control, alarm, and signal circuits, No 12 AWG.

### 3.5 FIRESTOPPING

- A. Comply with requirements in Division 07 Section "Penetration Firestopping."

### 3.6 GROUNDING

- A. For low-voltage wiring and cabling, comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

### 3.7 IDENTIFICATION

- A. Identify system components, wiring, and cabling according to TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

### END OF SECTION 260523





## **SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes methods and materials for grounding systems and equipment.

#### **1.2 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.

#### **1.3 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

### **PART 2 - PRODUCTS**

#### **2.1 CONDUCTORS**

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

#### **2.2 CONNECTORS**

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
  - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

#### **2.3 GROUNDING ELECTRODES**

- A. Ground Rods: Copper-clad steel; 3/4 inch nominal diameter by 10 feet in length.

### **PART 3 - EXECUTION**

#### **3.1 APPLICATIONS**

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade.
- C. Conductor Terminations and Connections:
  - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  - 2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
  - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
  - 4. Connections to Structural Steel: Welded connectors.

### 3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
  - 1. Feeders and branch circuits.
  - 2. Lighting circuits.
  - 3. Receptacle circuits.
  - 4. Single-phase motor and appliance branch circuits.
  - 5. Three-phase motor and appliance branch circuits.
  - 6. Flexible raceway runs.
  - 7. Armored and metal-clad cable runs.
  - 8. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- C. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- D. Grounding bus riser as indicated on Drawings.
- E. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

### 3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade, unless otherwise indicated.
  - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
  - 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
  - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
  - 3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
- D. Grounding and Bonding for Piping:
  - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
  - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
  - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

- E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

**END OF SECTION 260526**



## **SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes:
  - 1. Hangers and supports for electrical equipment and systems.
  - 2. Construction requirements for concrete bases.

#### **1.2 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

#### **1.3 SUBMITTALS**

- A. Product Data: For steel slotted support systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
  - 1. Trapeze hangers. Include Product Data for components.
  - 2. Steel slotted channel systems. Include Product Data for components.
  - 3. Equipment supports.
- C. Welding certificates.

#### **1.4 QUALITY ASSURANCE**

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

### **PART 2 - PRODUCTS**

#### **2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS**

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Allied Tube & Conduit.
    - b. Cooper B-Line, Inc.; a division of Cooper Industries.
    - c. ERICO International Corporation.
    - d. GS Metals Corp.
    - e. Thomas & Betts Corporation.
    - f. Unistrut; Tyco International, Ltd.
    - g. Wesanco, Inc.
  - 3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  - 4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
  - 5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.

6. Channel Dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- 1) Hilti Inc.
- 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
- 3) MKT Fastening, LLC.
- 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- 1) Cooper B-Line, Inc.; a division of Cooper Industries.
- 2) Empire Tool and Manufacturing Co., Inc.
- 3) Hilti Inc.
- 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
- 5) MKT Fastening, LLC.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.

5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.

6. Toggle Bolts: All-steel springhead type.

7. Hanger Rods: Threaded steel.

## 2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

## PART 3 - EXECUTION

### 3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  - 1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

### 3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To New Concrete: Bolt to concrete inserts.
  - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 4. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
  - 5. To Light Steel: Sheet metal screws.
  - 6. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

### 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

### 3.4 CONCRETE BASES

- A. Construct concrete bases 6 inches tall and 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base. Furnish and install concrete base at all floor-mounted electrical equipment including panelboards and transformers.
- B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."
- C. Anchor equipment to concrete base.
  - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

### 3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

**END OF SECTION 260529**



## **SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. See Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks and manholes, and underground handholes, boxes, and utility construction.

#### **1.2 SUBMITTALS**

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, details, and attachments to other work.

#### **1.3 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

### **PART 2 - PRODUCTS**

#### **2.1 METAL CONDUIT AND TUBING**

- A. Rigid Steel Conduit: ANSI C80.1.
- B. IMC: ANSI C80.6.
- C. EMT: ANSI C80.3.
- D. FMC: Zinc-coated steel.
- E. LFMC: Flexible steel conduit with PVC jacket.
- F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
  - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
  - 2. Fittings for EMT: compression type.

#### **2.2 NONMETALLIC CONDUIT AND TUBING**

- A. ENT: NEMA TC 13.
- B. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.
- C. LFNC: UL 1660.
- D. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.
- E. Fittings for LFNC: UL 514B.

## 2.3 METAL WIREWAYS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Cooper B-Line, Inc.
  - 2. Hoffman.
  - 3. Square D; Schneider Electric.
- B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.
- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Screw-cover type.
- E. Finish: Manufacturer's standard enamel finish.

## 2.4 NONMETALLIC WIREWAYS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Hoffman.
  - 2. Lamson & Sessions; Carlon Electrical Products.
- C. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.
- D. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

## 2.5 BOXES, ENCLOSURES, AND CABINETS

- A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.
- C. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
- D. Metal Floor Boxes: Cast metal, fully adjustable, rectangular.
- E. Nonmetallic Floor Boxes: Nonadjustable, round.
- F. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- G. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- H. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
  - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
  - 2. Nonmetallic Enclosures: Plastic.
- I. Cabinets:
  - 1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
  - 2. Hinged door in front cover with flush latch and concealed hinge.
  - 3. Key latch to match panelboards.
  - 4. Metal barriers to separate wiring of different systems and voltage.
  - 5. Accessory feet where required for freestanding equipment.

## PART 3 - EXECUTION

### 3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
  - 1. Exposed Conduit: Rigid steel conduit.
  - 2. Concealed Conduit, Aboveground: EMT.
  - 3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
  - 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  - 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Comply with the following indoor applications, unless otherwise indicated:
  - 1. Exposed, Not Subject to Physical Damage: EMT.
  - 2. Exposed, Not Subject to Severe Physical Damage: EMT.
  - 3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
    - a. Loading dock.
  - 4. Concealed in Ceilings and Interior Walls and Partitions: EMT or metal-clad cable, type MC.
    - a. EMT or metal-clad cable, type MC.
      - 1) Type MC cable may be used in lieu of EMT conduit only for branch circuits (with up to four conductors not including ground conductor) and only in dry concealed locations above grade except where specifically not permitted by the NEC or this specification.
        - a) Type MC cable shall **not** be permitted for the following uses:
          - 1. Concealed within walls and partitions (MC cable allowed only above ceilings).
          - 2. Connections to panelboards (MC cable can terminate in a wireway gutter located above the panel, and above the accessible ceiling).
          - 3. Where exposed to view.
          - 4. Where exposed to damage.
          - 5. Hazardous locations.
          - 6. Wet locations.
        - b) UL listed connectors with insulated bushings and offset screw connections shall be utilized for MC cable installations.
        - c) Type MC cable shall be supported and secured within twelve (12) inches of every outlet box or fitting.
        - d) Type MC cable whips may be utilized in lieu of flexible conduit and wire for wiring from light fixtures in accessible ceilings to junction boxes above ceiling. Cable whip lengths shall be sufficient to allow for relocating each light fixture within a five (5) foot radius of its installed location.
  - 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
  - 6. Damp or Wet Locations: Rigid steel conduit.
  - 7. Raceways for Optical Fiber or Communications Cable: EMT.
  - 8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, stainless steel in damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
  - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

### 3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."

- E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- H. Raceways Embedded in Slabs:
  - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
  - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
  - 3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.
- I. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- J. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- K. Raceways for Optical Fiber and Communications Cable: Install as follows:
  - 1. 3/4-Inch Trade Size: Install raceways in maximum lengths of 50 feet.
  - 2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.
  - 3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- L. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
  - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  - 2. Where otherwise required by NFPA 70.
- M. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
  - 1. Use LFMC in damp or wet locations subject to severe physical damage.
  - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- N. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
- O. Set metal floor boxes level and flush with finished floor surface.
- P. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

### 3.3 INSTALLATION OF UNDERGROUND CONDUIT

- A. Direct-Buried Conduit:
  - 1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than 6 inches in nominal diameter.
  - 2. Install backfill as specified in Division 31 Section "Earth Moving."
  - 3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
  - 4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
    - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
    - b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

#### 3.4 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

**END OF SECTION 260533**



## **SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Identification of power and control cables.
  - 2. Identification for conductors.
  - 3. Underground-line warning tape.
  - 4. Warning labels and signs.
  - 5. Instruction signs.
  - 6. Equipment identification labels.
  - 7. Miscellaneous identification products.

#### **1.2 SUBMITTALS**

- A. Product Data: For each electrical identification product indicated.

#### **1.3 QUALITY ASSURANCE**

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

### **PART 2 - PRODUCTS**

#### **2.1 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS**

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

#### **2.2 CONDUCTOR IDENTIFICATION MATERIALS**

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

#### **2.3 WARNING LABELS AND SIGNS**

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- C. Baked-Enamel Warning Signs:
  - 1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
  - 2. 1/4-inch grommets in corners for mounting.

3. Nominal size, 7 by 10 inches.

D. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

## 2.4 EQUIPMENT IDENTIFICATION LABELS

A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

## 2.5 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Apply identification devices to surfaces that require finish after completing finish work.
- C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

## 3.2 IDENTIFICATION SCHEDULE

- A. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.
    - a. Color shall be factory applied.
    - b. Colors for 208/120-V Circuits:
      - 1) Phase A: Black.
      - 2) Phase B: Red.
      - 3) Phase C: Blue.
    - c. Colors for 480/277-V Circuits:
      - 1) Phase A: Brown.
      - 2) Phase B: Orange.
      - 3) Phase C: Yellow.
    - d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- B. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- C. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
1. Install underground-line warning tape for both direct-buried cables and cables in raceway.



- a. Tape shall be red in color, 6" wide & 4 mils thick, alkali & acid resistant with metallic core.
- D. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
  - 1. Comply with 29 CFR 1910.145.
  - 2. Identify system voltage with black letters on an orange background.
  - 3. Apply to exterior of door, cover, or other access.
  - 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
    - a. Power transfer switches.
    - b. Controls with external control power connections.
- E. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- F. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
  - 1. Labeling Instructions:
    - a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
    - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
    - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
    - d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

**END OF SECTION 260553**



## **SECTION 260923 - LIGHTING CONTROL DEVICES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Time switches.
  - 2. Photoelectric switches.
  - 3. Standalone daylight-harvesting controls.
  - 4. Indoor occupancy sensors.
  - 5. Lighting contactors.
  - 6. Emergency shunt relays.

#### **1.2 SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: Show installation details for occupancy and light-level sensors.
  - 1. Interconnection diagrams showing field-installed wiring.
  - 2. Include diagrams for power, signal, and control wiring.

#### **1.3 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

### **PART 2 - PRODUCTS**

#### **2.1 TIME SWITCHES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cooper Industries, Inc.
  - 2. Intermatic, Inc.
  - 3. Invensys Controls.
  - 4. Leviton Manufacturing Co., Inc.
  - 5. NSi Industries LLC.
  - 6. Tyco Electronics.
- B. Electronic Time Switches: Solid state, programmable, with alphanumeric display; complying with UL 917.
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. Contact Configuration: SPST.
  - 3. Contact Rating: 20-A ballast load, 120-/240-V ac.
  - 4. Programs: Two on-off set points on a 24-hour schedule, allowing different set points for each day of the week and an annual holiday schedule that overrides the weekly operation on holidays.
  - 5. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.
  - 6. Astronomic Time: All channels.
  - 7. Automatic daylight savings time changeover.
  - 8. Battery Backup: Not less than seven days reserve, to maintain schedules and time clock.

#### **2.2 OUTDOOR PHOTOELECTRIC SWITCHES**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cooper Industries, Inc.
  - 2. Intermatic, Inc.
  - 3. NSi Industries LLC.
  - 4. Tyco Electronics.

- B. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of the photocell to prevent fixed light sources from causing turn-off.
  - 3. Time Delay: Fifteen second minimum, to prevent false operation.
  - 4. Surge Protection: Metal-oxide varistor.
  - 5. Mounting: Twist lock complies with NEMA C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

## 2.3 DAYLIGHT-HARVESTING DIMMING CONTROLS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cooper Industries, Inc.
  - 2. Hubbell Building Automation, Inc.
  - 3. Leviton Manufacturing Co., Inc.
  - 4. Lithonia Lighting; Acuity Brands Lighting, Inc.
  - 5. Watt Stopper.
- B. System Description: Sensing daylight and electrical lighting levels, the system adjusts the indoor electrical lighting levels. As daylight increases, the lights are dimmed.
  - 1. Lighting control set point is based on two lighting conditions:
    - a. When no daylight is present (target level).
    - b. When significant daylight is present.
  - 2. System programming is done with two hand-held, remote-control tools.
    - a. Initial setup tool.
    - b. Tool for occupants to adjust the target levels by increasing the set point up to 25 percent, or by minimizing the electric lighting level.
- C. Ceiling-Mounted Dimming Controls: Solid-state, light-level sensor unit, with separate controller unit, to detect changes in lighting levels that are perceived by the eye.
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. Sensor Output: 0- to 10-V dc to operate electronic dimming ballasts. Sensor is powered by controller unit.
  - 3. Power Pack: Sensor has 24-V dc, Class 2 power source, as defined by NFPA 70.
  - 4. Light-Level Sensor Set-Point Adjustment Range: 20 to 60 fc.

## 2.4 INDOOR OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cooper Industries, Inc.
  - 2. Hubbell Building Automation, Inc.
  - 3. Leviton Manufacturing Co., Inc.
  - 4. Lightolier Controls.
  - 5. Lithonia Lighting; Acuity Brands Lighting, Inc.
  - 6. Lutron Electronics Co., Inc.
  - 7. Sensor Switch, Inc.
  - 8. Square D.
  - 9. Watt Stopper.
- B. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes.
  - 3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
  - 4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
  - 5. Mounting:

- a. Sensor: Suitable for mounting in any position on a standard outlet box.
  - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
  - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
- 6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
- C. PIR Type: Ceiling mounted; detect occupants in coverage area by their heat and movement.
  - 1. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in..
- D. Ultrasonic Type: Ceiling mounted; detect occupants in coverage area through pattern changes of reflected ultrasonic energy .
  - 1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
- E. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.
  - 1. Sensitivity Adjustment: Separate for each sensing technology.
  - 2. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.

## 2.5 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cooper Industries, Inc.
  - 2. Hubbell Building Automation, Inc.
  - 3. Leviton Manufacturing Co., Inc.
  - 4. Lightolier Controls.
  - 5. Lithonia Lighting; Acuity Brands Lighting, Inc.
  - 6. Lutron Electronics Co., Inc.
  - 7. Sensor Switch, Inc.
  - 8. Square D.
  - 9. Watt Stopper.
- B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
  - 3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.

## 2.6 LIGHTING CONTACTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Allen-Bradley/Rockwell Automation.
  - 2. ASCO Power Technologies, LP; a business of Emerson Network Power.
  - 3. Eaton Corporation.
  - 4. General Electric Company.
  - 5. Square D.
- B. Description: Electrically operated and electrically held, combination-type lighting contactors with nonfused disconnect, complying with NEMA ICS 2 and UL 508.
  - 1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
  - 2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
  - 3. Enclosure: Comply with NEMA 250.
  - 4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

- C. Interface with DDC System for HVAC: Provide hardware interface to enable the DDC system for HVAC to monitor and control lighting contactors.
  - 1. Monitoring: On-off status.
  - 2. Control: On-off operation.

## 2.7 EMERGENCY SHUNT RELAY

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Lighting Control and Design.
  - 2. Watt Stopper.
- B. Description: Normally closed, electrically held relay, arranged for wiring in parallel with manual or automatic switching contacts; complying with UL 924.
  - 1. Coil Rating: 120 or 277 V.

## 2.8 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG.
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG.
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG.

## PART 3 - EXECUTION

### 3.1 SENSOR INSTALLATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

### 3.2 WIRING INSTALLATION

- A. Wiring Method: Minimum conduit size is 3/4 inch.
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

### 3.3 IDENTIFICATION

- A. Identify components and power and control wiring.
  - 1. Identify controlled circuits in lighting contactors.
  - 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

### 3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

- B. Lighting control devices will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.5 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

**END OF SECTION 260923**





## **SECTION 262726 - WIRING DEVICES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
  - 2. Snap switches and wall-box dimmers.
  - 3. Wall-switch and exterior occupancy sensors.

#### **1.2 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

#### **1.3 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

### **PART 2 - PRODUCTS**

#### **2.1 STRAIGHT BLADE RECEPTACLES**

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
  - 1. Products: Leviton is basis of design. Subject to compliance with requirements, provide one of the following:
    - a. Cooper; 5351 (single), 5352 (duplex).
    - b. Hubbell; HBL5351 (single), CR5352 (duplex).
    - c. Leviton; 5891 (single), 5352 (duplex).
    - d. Pass & Seymour; 5381 (single), 5352 (duplex).
- B. Tamper resistant Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; TRBR20 (duplex).
    - b. Hubbell; BR20 (duplex).
    - c. Leviton; TBR20 (duplex).
    - d. Pass & Seymour; TR20 (duplex).

#### **2.2 GFCI RECEPTACLES**

- A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
  - 1. Products: Leviton is basis of design. Subject to compliance with requirements, provide one of the following:
    - a. Cooper; GF20.
    - b. Hubbell; GFRST20.
    - c. Leviton; 7899.
    - d. Pass & Seymour; 2084).

## 2.3 SNAP SWITCHES

- A. Comply with NEMA WD 1 and UL 20.
- B. Switches, 120/277 V, 20 A:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
    - b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
    - c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
    - d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).

## 2.4 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable toggle switch; with single-pole or three-way switching. Comply with UL 1472.
- C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.
  - 1. Dimmers shall be rated for load served. Coordinate with specific applications indicated on the Drawings.
- D. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

## 2.5 OCCUPANCY SENSORS

- A. Provide occupancy sensors as noted on Drawings. Provide all power packs and accessories for a complete and operable lighting control system as required to support sensors and control devices indicated on Drawings.

## 2.6 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
  - 1. Plate-Securing Screws: Metal with head color to match plate finish.
  - 2. Material for Finished Spaces: 0.035-inch-thick, satin-finished stainless steel.
  - 3. Material for Unfinished Spaces: Galvanized steel.
  - 4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

## 2.7 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
  - 1. Back of House, Unfinished: Gray devices, steel plates.
  - 2. Back of House, Finished: Gray devices, stainless plates.
  - 3. Public Spaces: Gray devices, stainless plates.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
  - 1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.

2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
  3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
  4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
  2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
  3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
  4. Existing Conductors:
    - a. Cut back and pigtail, or replace all damaged conductors.
    - b. Straighten conductors that remain and remove corrosion and foreign matter.
    - c. Pigtailing existing conductors is permitted provided the outlet box is large enough.
- D. Device Installation:
1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
  2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
  3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
  4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
  5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
  6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
  7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
  8. Tighten unused terminal screws on the device.
  9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the left.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Dimmers:
1. Install dimmers within terms of their listing.
  2. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
- H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

## END OF SECTION 262726



## SECTION 265119 - LED INTERIOR LIGHTING

### 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 solid-state luminaires that use LED technology.
  - 2. Lighting fixture supports.

#### 1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Arrange in order of luminaire designation.
  - 2. Include data on features, accessories, and finishes.
  - 3. Include physical description and dimensions of luminaires.
  - 4. Include emergency lighting units, including batteries and chargers.
  - 5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
  - 6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project, IES LM-79, and IES LM-80.
    - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Shop Drawings: For nonstandard or custom luminaires.
  - 1. Include plans, elevations, sections, and mounting and attachment details.
  - 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Include diagrams for power, signal, and control wiring.
- C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.
- D. Product Certificates: For each type of luminaire.
- E. Sample warranty.

## 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
  - 1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

## 1.6 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
- B. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

## 1.7 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five year(s) from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 LUMINAIRE 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.
- B. Recessed Fixtures: Comply with NEMA LE 4.
- C. CRI of 80 (minimum). CCT of 4000 K unless otherwise indicated.
- D. Rated lamp life of 50,000 (minimum) hours.
- E. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- F. Internal driver.

### 2.2 MATERIALS

- A. Metal Parts:
  - 1. Free of burrs and sharp corners and edges.
  - 2. Sheet metal components shall be steel unless otherwise indicated.
  - 3. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- C. Diffusers and Globes:
  - 1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
  - 2. Glass: Annealed crystal glass unless otherwise indicated.
  - 3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
- D. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
  - 1. Label shall include the following lamp characteristics:
    - a. "USE ONLY" and include specific lamp type.
    - b. Lamp diameter, shape, size, wattage, and coating.
    - c. CCT and CRI for all luminaires.

## 2.3 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

## 2.4 LUMINAIRE FIXTURE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage.
- D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

## 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 roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Remote Mounting of Ballasts: Distance between the ballast and luminaire shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.
- C. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- D. Install lamps in each luminaire.
- E. Coordinate layout and installation of luminaires and suspension system with other construction that penetrates ceilings or is supported by them.
- F. Supports:
  - 1. Sized and rated for luminaire weight.
  - 2. Able to maintain luminaire position after cleaning and relamping.
  - 3. Provide support for luminaire without causing deflection of ceiling or wall.
  - 4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.
- G. Ceiling-Grid-Mounted Luminaire Supports: Use grid as a support element.
  - 1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each luminaire. Locate not more than 6 inches from luminaire corners.
  - 2. Support Clips: Fasten to luminaires and to ceiling grid members at or near each luminaire corner with clips that are UL listed for the application.
  - 3. Luminaires of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support luminaires independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.
  - 4. Install at least one independent support rod or wire from structure to a tab on luminaire. Wire or rod shall have breaking strength of the luminaire weight at a safety factor of 3.

- H. Flush-Mounted Luminaire Support:
  - 1. Secured to outlet box.
  - 2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
  - 3. Trim ring flush with finished surface.
- I. Wall-Mounted Luminaire Support:
  - 1. Attached to structural members in walls.
  - 2. Do not attach luminaires directly to gypsum board.
- J. Suspended Luminaire Support:
  - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
  - 2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
  - 3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
  - 4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- K. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

### 3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### 3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
  - 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.

### 3.5 ADJUSTING

- A. Occupancy Adjustments: Provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Some of this work may be required during hours of darkness.
  - 1. Adjust the aim of luminaires in the presence of the Architect.

## END OF SECTION 265119



## **SECTION 265219 - EMERGENCY AND EXIT LIGHTING**

### **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. Emergency lighting units.
  - 2. Exit signs.
  - 3. Luminaire supports.

#### **1.3 DEFINITIONS**

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Emergency Lighting Unit: A lighting unit with internal or external emergency battery powered supply and the means for controlling and charging the battery and unit operation.
- D. Fixture: See "Luminaire" Paragraph.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

#### **1.4 SUBMITTALS**

- A. Product Data: For each type of emergency lighting unit, exit sign, and emergency lighting support.
  - 1. Include data on features, accessories, and finishes.
  - 2. Include physical description of the unit and dimensions.
  - 3. Battery and charger for light units.
  - 4. Include life, output of luminaire (lumens, CCT, and CRI), and energy-efficiency data.
  - 5. Include photometric data and adjustment factors based on laboratory tests, complying with IES LM-45, for each luminaire type.
    - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Product Schedule:
  - 1. For emergency lighting units. Use same designations indicated on Drawings.
  - 2. For exit signs. Use same designations indicated on Drawings.
- C. Product Certificates: For each type of luminaire.
- D. Sample Warranty: For manufacturer's warranty.

#### **1.5 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in emergency, operation, and maintenance manuals.
  - 1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

## 1.6 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

## 1.7 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Two year(s) from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

- 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.
- B. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.
- C. Comply with NFPA 70 and NFPA 101.
- D. Comply with NEMA LE 4 for recessed luminaires.
- E. Comply with UL 1598 for fluorescent luminaires.
- F. Lamp Base: Comply with ANSI C81.61 or IEC 60061-1.
- G. Bulb Shape: Complying with ANSI C79.1.

### 2.2 EMERGENCY LUMINAIRES

- A. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body and compatible with ballast.
  - 1. Emergency Connection: Operate lamp(s) continuously at an output of 1100 (minimum) lumens upon loss of normal power. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire ballast or driver.
  - 2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
  - 3. Test Push-Button and Indicator Light: Visible and accessible without opening luminaire or entering ceiling space.
    - a. Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
    - b. Indicator Light: LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
  - 4. Battery: Sealed, maintenance-free, nickel-cadmium type.
  - 5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
  - 6. Integral Self-Test (When Specified on Drawings): Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.
- B. External Type: Self-contained, modular, battery-inverter unit, suitable for powering one or more lamps, remote mounted from luminaire.
  - 1. Emergency Connection: Operate fluorescent or LED lamp(s) continuously. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire ballast or driver.
  - 2. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
  - 3. Battery: Sealed, maintenance-free, nickel-cadmium type.

4. Charger: Fully automatic, solid-state, constant-current type.
5. Housing: NEMA 250, Type 1 enclosure listed for installation inside, on top of, or remote from luminaire. Remote assembly shall be located no less than half the distance recommended by the ballast, driver, or emergency power unit manufacturer, whichever is less.
6. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
7. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
8. Remote Test: Switch in handheld remote device aimed in direction of tested unit initiates coded infrared signal. Signal reception by factory-installed infrared receiver in tested unit triggers simulation of loss of its normal power supply, providing visual confirmation of either proper or failed emergency response.
9. Integral Self-Test (When Specified on Drawings): Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

## 2.3 EMERGENCY LIGHTING UNITS

- A. General Requirements for Emergency Lighting Units: Self-contained units.
- B. Emergency Lighting Unit:
  1. Operating at nominal voltage of 120 V ac or 277 V ac.
  2. Wall or ceiling with universal junction box adaptor.
  3. UV stable thermoplastic housing.
  4. Two Halogen or LED lamp heads.
  5. Internal emergency power unit.
- C. Remote Emergency Lighting Units:
  1. Operating at nominal voltage of 120 V ac, 277 V ac, 6 V dc, 9.6 V dc, 12 V dc, or 24 V dc.
  2. Wall or ceiling with universal junction box adaptor.
  3. Steel housing rated for wet locations.
  4. Two Halogen or LED lamp heads.
  5. External emergency power unit.

## 2.4 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Signs:
  1. Operating at nominal voltage of 120 V ac or 277 V ac.
  2. Lamps for AC Operation: LEDs; 50,000 hours minimum rated lamp life.
  3. Self-Powered Exit Signs (Battery Type): Internal emergency power unit.

## 2.5 MATERIALS

- A. Metal Parts:
  1. Free of burrs and sharp corners and edges.
  2. Sheet metal components shall be steel unless otherwise indicated.
  3. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access:
  1. Smooth operating, free of light leakage under operating conditions.
  2. Designed to permit relamping without use of tools.
  3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

- B. Examine walls, floors, roofs, and ceilings for suitable conditions where emergency lighting luminaires will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Wall-Mounted Luminaire Support:
  - 1. Attached to structural members in walls.
  - 2. Do not attach luminaires directly to gypsum board.
- E. Suspended Luminaire Support:
  - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
  - 2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
- F. Ceiling Grid Mounted Luminaires:
  - 1. Secure to any required outlet box.
  - 2. Secure emergency power unit using approved fasteners in a minimum of four locations, spaced near corners of emergency power unit.
  - 3. Use approved devices and support components to connect luminaire to ceiling grid.

### 3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### 3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.

### END OF SECTION 265219

## SECTION 270000 - DISTRICT CABLING SPECIFICATIONS

### PART 1 - GENERAL

#### 1.1 SCOPE OF SERVICES

- A. Copper Cabling: CMP 66-240-xB. Cat 6 Superior Essex Datagain 6+, Plenum rated blue part number: 66-240-2B where noted. Open areas noted on prints would be CMP 66-240-4B (white).
- B. Cabling: CMP 6H-272-xB. Cat 6A Superior Essex, Plenum rated blue part number: 6H-272-2B where noted. Open areas, if noted on prints, would be 6H-272-4B (white).
- C. Cable Management
  - 1. No electrical tape or zip ties for bundling cables or attaching to j-hooks.
  - 2. Black plenum rated Velcro strips only for bundling cable. White plenum rated Velcro strips for the locations with white cabling.
  - 3. On the 48-port patch panels, both cable management bars are to be installed and utilized.
  - 4. On all cable terminations, stuffer caps are required at the field and closet locations.
  - 5. When dressing cables on the back of the patch panels, half of the cables will run down the left side and the other half down the right side of the rack.
  - 6. New cables that are damaged during installation, such as a sliced or cut, even if they pass testing, must be replaced and tested and the old cabling removed.
  - 7. Damage to other cabling or systems not part of this project must be remedied by the vendor utilizing authorized vendors and/or cabling approved by the District at no cost to the District.
  - 8. During installation of new cabling, ceiling tiles along artery routes are to be left open until inspected by District Technology staff. Damaged tile and/or grid will need to be replaced by the vendor and will need to match existing tile and grid. Vendors will be responsible for closing all ceiling tiles after District inspections.
  - 9. Old Ethernet, fiber and enclosures, where applicable, not used will need to be removed and discarded by the vendor. This would also include any empty innerducts.
  - 10. The District can provide ceiling tiles for any data closets that would need to be recut by the vendor to accommodate cabling pathways.
  - 11. Any penetration that is not drywall material will need a sleeve and pull string (for future runs) installed per applicable codes.
  - 12. Service loops of approximately 10-15' should be installed above the ceiling at each endpoint location as well as at each MDF/IDF rack location.
  - 13. For any endpoint locations and/or conduit pathways that are vacated, add a pull string from wall location to above ceiling/starting point to ending point and cover with a correctly sized faceplate/metal cover.
  - 14. All data, voice, access control, etc. cables shall be within raceway, J-hooks or other designated cable delivery system. Successful bidder must provide all hardware to run and secure Ethernet, fiber, etc. as specified by applicable codes and ordinances.
  - 15. Cable trunks should be secured above HVAC duct where applicable unless otherwise approved by the District. All cable should be neatly run within the cable trunk until branching off to an endpoint.
- D. Clarity Rear-Load High Density Jack Panel Kits
  - 1. 48 Port Panel: 48-port, panel jack panel kit, flat, unloaded, 1 RU, Part: OR-PHDHJU48. All slots must be populated.
  - 2. Rear-load jacks part OR-HDJ6-00 Black (Cat 6) and part OR-HDJ6A-36 (Cat 6a). Blue.
  - 3. **All rows in each panel must be filled with the same type of panel jack. No mixing of Cat 6 and 6a jacks in a row. In a 48-port panel there can be a row of 24 Cat 6 and a row of 24 Cat 6a panel jacks. All ports must be terminated from left to right with no skipping of ports on the panel.**
- E. Above ceiling: TracJack Surface Mount Box. Part: OR- 404HDJ2 (Fog White) for locations with two or less cables. For locations with three or four cables, use OR-404HDJ4 (Fog White). For locations with five or six cables, use OR-404HDJ6 (Fog White). TracJacks OR-HDJ6 Fog White (Cat 6) and part OR-HDJ6A-36 Blue (Cat 6a).
- F. Wall installation where applicable:
  - 1. Wall mount box single: Part: OR-403HDJ16 Fog white
  - 2. Wall mount box dual: Part: OR-403HDJ212 Fog white
  - 3. Extra deep wall mount single: Part: Wiremold NM2044FW (for HDMI locations)
  - 4. Extra deep wall mount double: Part Wiremold NM2044-2FW (for HDMI locations)
  - 5. Wall mount box jack: Part: OR-HDJ6 Fog white

6. 6-port Faceplate: 403HDJ16 (Fog White) for single gang boxes. NOTE: All vacant slots must be filled with blanks
  7. 4-port Faceplate: 419HDJ4-88 (Fog White) for dual gang boxes with half electrical where applicable.
  8. 12-port Faceplate: 403HDJ212 (Fog White) for dual-gang boxes. NOTE: All vacant slots must be filled with blanks
  9. Blank module, OR-HDJB (Fog White). All vacant slots must be filled with blanks
  10. Wall mount box AV jack where applicable: OR-HDJ5E-68 (Dark Gray)
  11. Wall/Ceiling mount blanks: Blank module, OR-HDJB20. All unpopulated jacks must have a blank installed.
  12. Legrand-Wiremold PN10L10FW (Fog White-8 ft section)
  13. Legrand-Wiremold PN10F86FW (Fog White-Ceiling Connector)
  14. NOTE: All field Ethernet installations must be installed in the upper most top left location available and go from left to right and then down to the next available row, etc.
- G. Labeling: All locations (fiber, Ethernet, etc.) are to be labeled in typewritten format or owner approved equivalent. Plastic protective covers that come with cable boxes are required. Hand-written location labels will not be permitted. Verify closet designations with the owner.
1. Field Termination: All location labels are to be installed behind the factory transparent plastic protector clearly indicating the closet, panel and port number. For example, in IDF L, jack locations are to be labeled by closet, panel and then port number. For example, L-2-01 would represent Closet L, Panel 2, Port 01. Multiple ports on a field termination endpoint would be labeled as "L-2-01 L-2-02". Label numbers should be above the termination box ports and endpoint terminations should always start at the top of the endpoint termination box. Numbers should be sequential in order where possible. For example, on a two-port box, labels would be at the top. In a three-port example two at the top and one at the bottom. In a four-port box two at the top and two at the bottom and in a six-port box three at the top and three at the bottom. All labeling starts at the top left of the box.
  2. Closet Termination: The panels do not require port labels to match the field termination end points. Each panel will only need one identifying label in the upper left-hand corner. Examples include L-1, L-2, etc. Verify with owner for clarification.
- H. Ensure all cabling meets specifications utilizing a contractor provided certified tester following TIA-526-14-B guidelines. Provide OTLS test results for all Fiber Optic cabling delivered in written and magnetic media (USB drive or DVD). This includes testing and providing certification results for any cables that need to be pulled again after the initial testing results have been delivered to the District.
- I. Any item of equipment or material not specifically addressed on the drawings or in this document and required to provide a complete and functional installation shall be provided in a level of quality consistent with other specified items at no additional cost to the owner.
- J. Codes: Unless otherwise documented, the successful bidder must provide all hardware to run and secure all cabling and equipment racks as specified by applicable codes and ordinances. References include but are not limited to the following:
1. BICSI: Telecommunications Distribution Methods Manual (TDMM), latest edition
  2. TIA/EIA-568-C: Commercial Building Telecommunications Wiring Standard
  3. EIA/TIA-569B: Commercial Building Standard for Telecommunications Pathways and spaces
  4. TIA/EIA-606: Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
  5. National Electrical Code Article 770 "Optical Fiber Cables" and Article 800 "Communications Circuits"
  6. Local Electrical Code
  7. National Fire Protection Association (NFPA) 70 National Electrical Code
  8. OSHA 29 CFR 1926/1910 Safety and Health Standards
  9. Underwriters Laboratories, Inc. (UL) Listings and Approvals
  10. Country, state and local health, safety and building
- K. Penetrations of walls, floors and ceilings:
1. The Contractor shall make no penetration of floors, walls or ceiling without the prior consent of the owner.
  2. Where penetrations through acoustical walls or other walls for cableways are needed the Contractor will seal such penetrations in compliance with applicable code requirements.
  3. Where penetrations through fire-rated walls for cableways are needed the Contractor will seal such penetrations as required by code.
- L. General Installation
1. The contractor shall furnish all required installation tools to facilitate cable pulling without damage to fiber jacket.

2. All routing shall be kept clear of other trades work and supported using the method(s) mentioned in this section.
3. During pulling operation an adequate number of workers shall be present to allow fiber observation at all points of raceway entry and exit, as well as to feed fiber and operate pulling machinery.
4. Pull cables in accordance with cable manufacturer's recommendations and ANSI/IEEE C2 standards.
5. Pull all cabling by hand unless installation conditions require mechanical assistance.
6. Where mechanical assistance is used, ensure that maximum tensile load for fiber is not exceeded. This may be in the form of continuous monitoring of pulling tension, use of "break-away" or other approved method.
7. Any fiber shall be installed splice-free.
8. Avoid abrasion and other damage to cabling during installation.
9. If pulling lubricant is used it shall be non-injurious to cabling jacket and other materials used and not harden or become adhesive with age.
10. Minimum bend radii, as specified by the manufacturer, must be adhered to for pulling and final installation.
11. Any cabling bent or kinked to radius less than recommended dimension are not allowed and shall be replaced at no expense to owner.
12. Repair damage to interior spaces caused by installation of cable, raceway or other hardware.
13. Repairs must match preexisting color and finish of walls, floors and ceilings.

M. Documentation: An Excel spreadsheet will be prepared by vendor and submitted to the District in electronic format with at least the following information. Obtain official spreadsheet from customer.

1. Building name
2. Data closet number/identifier
3. Panel number
4. Port number
5. Terminated in wall, floor or ceiling
6. Room/Location Description

N. Door Controls Red Icon: Door control element wire, Windy City Wire part number 4461030 (or equivalent but must have a yellow jacket), to be ran from designated doors to the designated MDF/IDF. At each door location, there will be a 10-foot service loop starting at the top of the door frame. At the designated MDF/IDF, cable must be able to touch the ground plus four feet. All terminations will be completed by District staff or contractor.

O. Specialized Drops: If the map indicates something like HVAC, Door Controls, etc. next to the data drop symbol, the cable must be terminated inside of the enclosure. Note that the enclosure might not be installed at the time the cable is run. The cables will still be terminated in a biscuit and labeled accordingly. Coordinate with Network Administrator or Technology Director.

P. Specialized Systems: Additional cable will need to be pulled for intercom and intrusion detection systems. Cabling for intercom locations will be 2-conductor 18-gauge unshielded plenum rated cable (yellow in color). Intrusion detection will be 18 gauge 4-conductor unshielded plenum rated cable (gray in color). All locations and routes will be identified on the maps and handed out at the walk through. Verify where cable needs to be landed and labeled for each specialized system. For example, intercom cabling is usually routed to the bottom of the equipment rack and labeled in the data closets.

## 1.2 VENDOR QUALIFICATIONS

- A. The contractor must employ and utilize a BICSI RCDD in good standing at all times during the entire installation of this system.
- B. The contractor must have a minimum of five (5) years' experience on similar cabling systems.
- C. Vendor must agree to e-rate guidelines, have a valid SPIN number AND have a SPAC form on file that is not outdated.
- D. The Vendor must also have the necessary certifications to provide the nCompass Warranty offered between Legrand Ortronics and Superior Essex. The network cabling infrastructure must be installed by Supplier approved designers and Certified Contractors at the Certified Installer Plus-Enterprise Solutions Partner (CIP-ESP) tier or Certified Installer Plus (CIP) tier in accordance with manufacturer's installation instructions and specifications. Copies of certifications must be attached to the Vendor's response for evaluation by The Customer.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

**END OF SECTION 270000**



## **SECTION 270500 - COMMON WORK RESULTS FOR COMMUNICATIONS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Sleeves for pathways and cables.
  - 2. Sleeve seals.
  - 3. Grout.
  - 4. Common communications installation requirements.

#### **1.2 SUBMITTALS**

- A. Product Data: For sleeve seals.

### **PART 2 - PRODUCTS**

#### **2.1 SLEEVES FOR PATHWAYS AND CABLES**

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel.
  - 1. Minimum Metal Thickness:
    - a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
    - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

#### **2.2 SLEEVE SEALS**

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.
  - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of pathway or cable.
  - 3. Pressure Plates: Plastic. Include two for each sealing element.

#### **2.3 GROUT**

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

### **PART 3 - EXECUTION**

#### **3.1 COMMON REQUIREMENTS FOR COMMUNICATIONS INSTALLATION**

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both communications equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

### 3.2 SLEEVE INSTALLATION FOR COMMUNICATIONS PENETRATIONS

- A. Communications penetrations occur when pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and pathway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
  - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pathway and cable penetrations. Install sleeves and seal pathway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- K. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between pathway or cable and sleeve for installing mechanical sleeve seals.

### 3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

#### 3.4 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for communications installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

**END OF SECTION 270500**



## **SECTION 270526 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS**

### **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. Grounding conductors.
  - 2. Grounding connectors.
  - 3. Grounding busbars.
  - 4. Grounding rods.
  - 5. Grounding labeling.

#### **1.3 DEFINITIONS**

- A. BCT: Bonding conductor for telecommunications.
- B. EMT: Electrical metallic tubing.
- C. TGB: Telecommunications grounding busbar.
- D. TMGB: Telecommunications main grounding busbar.

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: For communications equipment room signal reference grid. Include plans, elevations, sections, details, and attachments to other work.

#### **1.5 INFORMATIONAL SUBMITTALS**

- A. As-Built Data: Plans showing as-built locations of grounding and bonding infrastructure, including the following:
  - 1. Ground rods.
  - 2. Ground and roof rings.
  - 3. BCT, TMGB, TGBs, and routing of their bonding conductors.
- B. Qualification Data: For Installer, installation supervisor, and field inspector.
- C. Field quality-control reports.

#### **1.6 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.
  - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
    - a. Result of the ground-resistance test, measured at the point of BCT connection.
    - b. Result of the bonding-resistance test at each TGB and its nearest grounding electrode.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
  - 1. Installation Supervision: Installation shall be under the direct supervision of ITS Technician, who shall be present at all times when Work of this Section is performed at Project site.
  - 2. Field Inspector: Currently registered by BICSI as a registered communications distribution designer to perform the on-site inspection.

## PART 2 - PRODUCTS

### 2.1 SYSTEM COMPONENTS

- A. Comply with J-STD-607-A.

### 2.2 CONDUCTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Harger Lightning & Grounding.
  - 2. Panduit Corp.
  - 3. TE Connectivity Ltd.
- B. Comply with UL 486A-486B.
- C. Insulated Conductors: Stranded copper wire, green or green with yellow stripe insulation, insulated for 600 V, and complying with UL 83.
  - 1. Ground wire for custom-length equipment ground jumpers shall be No. 6 AWG, 19-strand, UL-listed, Type THHN wire.
  - 2. Cable Tray Equipment Grounding Wire: No. 6 AWG.
  - 3. <Double click to insert sustainable design text for lead content.>
- D. Cable Tray Grounding Jumper:
  - 1. Not smaller than No. 10 AWG and not longer than 12 inches. If jumper is a wire, it shall have a crimped grounding lug with one hole and standard barrel for one crimp. If jumper is a flexible braid, it shall have a one- or two-hole ferrule. Attach with grounding screw or connector provided by cable tray manufacturer.
- E. Bare Copper Conductors:
  - 1. Solid Conductors: ASTM B 3.
  - 2. Stranded Conductors: ASTM B 8.
  - 3. Tinned Conductors: ASTM B 33.
  - 4. Bonding Cable: 28 kmils, 14 strands of No. 17 AWG conductor, and 1/4 inch in diameter.
  - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
  - 6. Bonding Jumper: Tinned-copper tape, braided conductors terminated with two-hole copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

### 2.3 CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Burndy; Part of Hubbell Electrical Systems.
  - 2. Chatsworth Products, Inc.
  - 3. Harger Lightning & Grounding.
  - 4. Panduit Corp.
  - 5. TE Connectivity Ltd.
- B. Irreversible connectors listed for the purpose. Listed by an NRTL as complying with NFPA 70 for specific types, sizes, and combinations of conductors and other items connected. Comply with UL 486A-486B.
- C. Compression Wire Connectors: Crimp-and-compress connectors that bond to the conductor when the connector is compressed around the conductor. Comply with UL 467.

1. Electroplated tinned copper, C and H shaped.
- D. Signal Reference Grid Connectors: Combination of compression wire connectors, access floor grounding clamps, bronze U-bolt grounding clamps, and copper split-bolt connectors, designed for the purpose.
  - E. Busbar Connectors: Cast silicon bronze, solderless compression or exothermic-type, mechanical connector; with a long barrel and two holes spaced on 5/8- or 1-inch centers for a two-bolt connection to the busbar.
  - F. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

## 2.4 GROUNDING BUSBARS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Chatsworth Products, Inc.
  2. Harger Lightning & Grounding.
  3. Panduit Corp.
- B. TMGB: Predrilled, wall-mounted, rectangular bars of hard-drawn solid copper, ¼ inch thick by 4 inches wide by 29 inches long. The busbar shall be NRTL listed for use as TMGB and shall comply with J-STD-607-A.
  1. Predrilling shall be with holes for use with lugs specified in this Section.
  2. Mounting Hardware: Stand-off brackets that provide a 4-inch clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
  3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.

## 2.5 GROUND RODS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Harger Lightning & Grounding.
  2. TE Connectivity Ltd.
- B. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet in diameter.

## 2.6 LABELING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Brother International Corporation.
  2. HellermannTyton.
  3. Panduit Corp.
- B. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- C. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine the ac grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of the electrical system.
- B. Inspect the test results of the ac grounding system measured at the point of BCT connection.

- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with connection of the BCT only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Bonding shall include the ac utility power service entrance, the communications cable entrance, and the grounding electrode system. The bonding of these elements shall form a loop so that each element is connected to at least two others.
- B. Comply with NECA 1.
- C. Comply with J-STD-607-A.

### 3.3 APPLICATION

- A. Conductors: Install solid conductor for No. 8 AWG and smaller and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
  - 1. The bonding conductors between the TGB and structural steel of steel-frame buildings shall not be smaller than No. 3/0 AWG.
  - 2. The bonding conductors between the TMGB and structural steel of steel-frame buildings shall not be smaller than No. 3/0 AWG.
- B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2 AWG minimum.
- C. Conductor Terminations and Connections:
  - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
  - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
  - 4. Connections to Structural Steel: Welded connectors.
- D. Conductor Support:
  - 1. Secure grounding and bonding conductors at intervals of not less than 36 inches.
- E. Grounding and Bonding Conductors:
  - 1. Install in the straightest and shortest route between the origination and termination point, and no longer than required. The bend radius shall not be smaller than eight times the diameter of the conductor. No one bend may exceed 90 degrees.
  - 2. Install without splices.
  - 3. Support at not more than 36-inch intervals.
  - 4. Install grounding and bonding conductors in 3/4-inch PVC conduit until conduit enters a telecommunications room. The grounding and bonding conductor pathway through a plenum shall be in EMT. Conductors shall not be installed in EMT unless otherwise indicated.
    - a. If a grounding and bonding conductor is installed in ferrous metallic conduit, bond the conductor to the conduit using a grounding bushing that complies with requirements in Section 270528 "Pathways for Communications Systems," and bond both ends of the conduit to a TGB.

### 3.4 GROUNDING ELECTRODE SYSTEM

- A. The BCT between the TMGB and the ac service equipment ground shall not be smaller than No. 3/0 AWG.

### 3.5 GROUNDING BUSBARS

- A. Indicate locations of grounding busbars on Drawings. Install busbars horizontally, on insulated spacers 2 inches minimum from wall, 12 inches above finished floor unless otherwise indicated.



- B. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

### 3.6 CONNECTIONS

- A. Bond metallic equipment in a telecommunications equipment room to the grounding busbar in that room, using equipment grounding conductors not smaller than No. 6 AWG.
- B. Stacking of conductors under a single bolt is not permitted when connecting to busbars.
- C. Assemble the wire connector to the conductor, complying with manufacturer's written instructions and as follows:
  - 1. Use crimping tool and the die specific to the connector.
  - 2. Pretwist the conductor.
  - 3. Apply an antioxidant compound to all bolted and compression connections.
- D. Primary Protector: Bond to the TMGB with insulated bonding conductor.
- E. Interconnections: Interconnect all TGBs with the TMGB with the telecommunications backbone conductor. If more than one TMGB is installed, interconnect TMGBs using the grounding equalizer conductor. The telecommunications backbone conductor and grounding equalizer conductor size shall not be less than No. 3/0 AWG unless otherwise indicated.
- F. Telecommunications Enclosures and Equipment Racks: Bond metallic components of enclosures to the telecommunications bonding and grounding system. Bond the equipment grounding busbar to the TGB No. 6 AWG bonding conductors.
- G. Structural Steel: Where the structural steel of a steel frame building is readily accessible within the room or space, bond each TGB and TMGB to the vertical steel of the building frame.
- H. Shielded Cable: Bond the shield of shielded cable to the TGB in communications rooms and spaces. Comply with TIA/EIA-568-B.1 and TIA/EIA-568-B.2 when grounding screened, balanced, twisted-pair cables.
- I. Rack- and Cabinet-Mounted Equipment: Bond powered equipment chassis to the cabinet or rack grounding bar. Power connection shall comply with NFPA 70; the equipment grounding conductor in the power cord of cord- and plug-connected equipment shall be considered as a supplement to bonding requirements in this Section.
- J. Access Floors: Bond all metal parts of access floors to the TGB.
- K. Equipment Room Signal Reference Grid: Provide a low-impedance path between telecommunications cabinets, equipment racks, and the reference grid, using No. 6 AWG bonding conductors.
  - 1. Install the conductors in grid pattern on 4-foot centers, allowing bonding of one pedestal from each access floor tile.
  - 2. Bond the TGB of the equipment room to the reference grid at two or more locations.
  - 3. Bond all conduits and piping entering the equipment room to the TGB at the perimeter of the room.
- L. Towers and Antennas:
  - 1. Ground Ring: Buried at least 30 inches below grade and at least 24 inches from the base of the tower or mounting.
  - 2. Bond each tower base and metallic frame of a dish to the ground ring, buried at least 18 inches below grade.
  - 3. Bond the ground ring and antenna grounds to the equipment room TMGB or TGB, buried at least 30 inches below grade.
  - 4. Bond metallic fences within 6 feet of towers and antennas to the ground ring, buried at least 18 inches below grade.
  - 5. Special Requirements for Roof-Mounted Towers:
    - a. Roof Ring: Meet requirements for the ground ring except the conductors shall comply with requirements in Section 264113 "Lightning Protection for Structures."
    - b. Bond tower base footings steel, the TGB in the equipment room, and antenna support guys to the roof ring.

- c. Connect roof ring to the perimeter conductors of the lightning protection system.
- 6. Waveguides and Coaxial Cable:
  - a. Bond cable shields at the point of entry into the building to the TGB and to the cable entrance plate, using No. 2 AWG bonding conductors.
  - b. Bond coaxial cable surge arrester to the ground or roof ring using bonding conductor size recommended by surge-arrester manufacturer.

### 3.7 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.
- B. Comply with IEEE C2 grounding requirements.
- C. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches extends above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.
- D. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect grounding conductors to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

### 3.8 IDENTIFICATION

- A. Labels shall be preprinted or computer-printed type.
  - 1. Label TMGB(s) with "fs-TMGB," where "fs" is the telecommunications space identifier for the space containing the TMGB.
  - 2. Label TGB(s) with "fs-TGB," where "fs" is the telecommunications space identifier for the space containing the TGB.
  - 3. Label the BCT and each telecommunications backbone conductor at its attachment point: "WARNING! TELECOMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"

### 3.9 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
  - 2. Test the bonding connections of the system using an ac earth ground-resistance tester, taking two-point bonding measurements in each telecommunications equipment room containing a TMGB and a TGB and using the process recommended by BICSI TDMM. Conduct tests with the facility in operation.
    - a. Measure the resistance between the busbar and the nearest available grounding electrode. The maximum acceptable value of this bonding resistance is 100 milliohms.
  - 3. Test for ground loop currents using a digital clamp-on ammeter, with a full-scale of not more than 10 A, displaying current in increments of 0.01 A at an accuracy of plus/minus 2.0 percent.
    - a. With the grounding infrastructure completed and the communications system electronics operating, measure the current in every conductor connected to the TMGB and in each TGB. Maximum acceptable ac current level is 1 A.
- C. Excessive Ground Resistance: If resistance to ground at the BCT exceeds 5 ohms, notify Architect promptly and include recommendations to reduce ground resistance.
- D. Grounding system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

**END OF SECTION 270526**



## **SECTION 280500 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Sleeves for raceways and cables.
  - 2. Sleeve seals.
  - 3. Grout.
  - 4. Common electronic safety and security installation requirements.

#### **1.2 SUBMITTALS**

- A. Product Data: For sleeve seals.

### **PART 2 - PRODUCTS**

#### **2.1 SLEEVES FOR RACEWAYS AND CABLES**

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel.
  - 1. Minimum Metal Thickness:
    - a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
    - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

#### **2.2 SLEEVE SEALS**

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.

#### **2.3 GROUT**

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

### **PART 3 - EXECUTION**

#### **3.1 COMMON REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATION**

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electronic safety and security equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

### 3.2 SLEEVE INSTALLATION FOR ELECTRONIC SAFETY AND SECURITY PENETRATIONS

- A. Electronic safety and security penetrations occur when raceways, pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
  - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants".
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

### 3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### 3.4 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electronic safety and security installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

**END OF SECTION 280500**





## **SECTION 280513 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Low-voltage control cabling.
  - 2. Control-circuit conductors.
  - 3. Fire alarm wire and cable.
  - 4. Identification products.

#### **1.2 SUBMITTALS**

- A. Product Data: For each type of product indicated.
  - 1. For coaxial cable, include the following installation data for each type used:
    - a. Nominal OD.
    - b. Minimum bending radius.
    - c. Maximum pulling tension.
- B. Shop Drawings: Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements.
- C. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Maintenance data.

#### **1.3 QUALITY ASSURANCE**

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 50 or less.
- B. 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.

### **PART 2 - PRODUCTS**

#### **2.1 PATHWAYS**

- A. Support of Open Cabling: NRTL labeled for support of cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
  - 1. Support brackets with cable tie slots for fastening cable ties to brackets.
  - 2. Lacing bars, spools, J-hooks, and D-rings.
  - 3. Straps and other devices.
- B. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems."
  - 1. Outlet boxes shall be no smaller than 2 inches wide, 3 inches high, and 2-1/2 inches deep.

#### **2.2 LOW-VOLTAGE CONTROL CABLE**

- A. Paired Lock Cable: NFPA 70, Type CMG.
  - 1. 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors.
  - 2. PVC insulation.
  - 3. Unshielded.

4. PVC jacket.
  5. Flame Resistance: Comply with UL 1581.
- B. Plenum-Type, Paired Lock Cable: NFPA 70, Type CMP.
1. 1 pair, twisted, No. 16 AWG, stranded (19x29) tinned copper conductors.
  2. PVC insulation.
  3. Unshielded.
  4. PVC jacket.
  5. Flame Resistance: Comply with NFPA 262.
- C. Paired Lock Cable: NFPA 70, Type CMG.
1. 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors.
  2. PVC insulation.
  3. Unshielded.
  4. PVC jacket.
  5. Flame Resistance: Comply with UL 1581.
- D. Plenum-Type, Paired Lock Cable: NFPA 70, Type CMP.
1. 1 pair, twisted, No. 18 AWG, stranded (19x30) tinned copper conductors.
  2. Fluorinated ethylene propylene insulation.
  3. Unshielded.
  4. Plastic jacket.
  5. Flame Resistance: NFPA 262, Flame Test.

## 2.3 CONTROL-CIRCUIT CONDUCTORS

- A. Class 1 Control Circuits: Stranded copper, Type THHN-THWN, in raceway complying with UL 83.
- B. Class 2 Control Circuits: Stranded copper, Type THHN-THWN, in raceway complying with UL 83.
- C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type TW or TF, complying with UL 83.

## 2.4 FIRE ALARM WIRE AND CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Comtran Corp.
  2. Draka USA.
  3. Genesis Cable Products; Honeywell International, Inc.
  4. Rockbestos-Suprenant Cable Corporation.
  5. West Penn Wire/CDT; a division of Cable Design Technologies.
- B. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.
- C. Signaling Line Circuits: Twisted, shielded pair, size as recommended by system manufacturer.
1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a 2-hour rating.
- D. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
1. Low-Voltage Circuits: No. 16 AWG, minimum.
  2. Line-Voltage Circuits: No. 12 AWG, minimum.
  3. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, NRTL listed for fire alarm and cable tray installation, plenum rated, and complying with requirements in UL 2196 for a 2-hour rating.

## 2.5 IDENTIFICATION PRODUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Brady Corporation
  2. HellermannTyton.
  3. Kroy LLC.

4. Panduit Corp.

- B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- C. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

## 2.6 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.
- C. Cable will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF PATHWAYS

- A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.
- B. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
- C. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." for installation of conduits and wireways.
- D. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- E. Pathway Installation in Equipment Rooms:
  - 1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
  - 2. Install cable trays to route cables if conduits cannot be located in these positions.
  - 3. Secure conduits to backboard when entering room from overhead.
  - 4. Extend conduits 3 inches above finished floor.
  - 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- F. Backboards: Install backboards with 96-inch dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

### 3.2 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
  - 1. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets or terminals.
  - 2. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, and terminals.
  - 3. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
  - 4. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
  - 5. Pulling Cable: Do not exceed manufacturer's instructions as to allowable pulling tension. Monitor cable pull tensions.
- C. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

D. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.

### 3.3 FIRE ALARM WIRING INSTALLATION

A. Comply with NECA 1 and NFPA 72.

B. Wiring Method: Install wiring in metal raceway according to Division 26 Section "Raceway and Boxes for Electrical Systems."

1. Install plenum cable in environmental air spaces, including plenum ceilings.

C. Wiring Method:

1. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
2. Fire-Rated Cables: Use of 2-hour, fire-rated fire alarm cables, NFPA 70, Types MI and CI, is permitted.
3. Signaling Line Circuits: Power-limited fire alarm cables may be installed in the same cable or raceway as signaling line circuits.

D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

F. Color-Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color-code for alarm circuit wiring and another for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.

G. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.

H. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

### 3.4 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:

1. Class 1 remote-control and signal circuits, No. 14 AWG.
2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

### 3.5 FIRESTOPPING

A. Comply with requirements in Division 07 Section "Penetration Firestopping."

### 3.6 GROUNDING

- A. For low-voltage wiring and cabling, comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

### 3.7 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  - 1. Visually inspect cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding.
  - 2. Visually inspect cable placement, cable termination, grounding, and bonding.
- B. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide, or transfer the data from the instrument to the computer, save as text files, print, and submit.
- C. Prepare test and inspection reports.

**END OF SECTION 280513**



## **SECTION 283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM**

### **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-alarm control unit.
  - 2. Manual fire-alarm boxes.
  - 3. System smoke detectors.
  - 4. Heat detectors.
  - 5. Notification appliances.
  - 6. Device guards.
  - 7. Magnetic door holders.
  - 8. Remote annunciator.
  - 9. Addressable interface device.
- B. Related Requirements:
  - 1. Section 280513 "Conductors and Cables for Electronic Safety and Security" for cables and conductors for fire-alarm systems.
- C. Scope of work: Provide new devices on existing system and relocation/removal of existing devices on existing system.

#### **1.3 DEFINITIONS**

- A. EMT: Electrical Metallic Tubing.
- B. FACP: Fire Alarm Control Panel.
- C. HLI: High Level Interface.
- D. NICET: National Institute for Certification in Engineering Technologies.
- E. PC: Personal computer.
- F. VESDA: Very Early Smoke-Detection Apparatus.
- G. Pathway: Any circuit, conductor, optic fiber, radio carrier, or other means connecting two or more locations.

#### **1.4 SUBMITTALS**

- A. Product Data: For each type of product, including furnished options and accessories.
  - 1. Include construction details, material descriptions, dimensions, profiles, and finishes.
  - 2. Include rated capacities, operating characteristics, and electrical characteristics.
- B. Shop Drawings: For fire-alarm system.
  - 1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
  - 2. Include plans, elevations, sections, details, and attachments to other work.
  - 3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
  - 4. Detail assembly and support requirements.
  - 5. Include voltage drop calculations for notification-appliance circuits.

6. Include battery-size calculations.
7. Include input/output matrix.
8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
9. Include performance parameters and installation details for each detector.
10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
11. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

C. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:
  - a. Trained and certified by manufacturer in fire-alarm system design.
  - b. NICET-certified, fire-alarm technician; Level III minimum.
  - c. Licensed or certified by authorities having jurisdiction.

D. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
3. Indicate audible appliances required to produce square wave signal per NFPA 72.

E. Sample Warranty: For special warranty.

## 1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
  - a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
  - b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
  - c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
  - d. Riser diagram.
  - e. Device addresses.
  - f. Record copy of site-specific software.
  - g. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
    - 1) Equipment tested.
    - 2) Frequency of testing of installed components.
    - 3) Frequency of inspection of installed components.
    - 4) Requirements and recommendations related to results of maintenance.
    - 5) Manufacturer's user training manuals.
  - h. Manufacturer's required maintenance related to system warranty requirements.
  - i. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.

## 1.6 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. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
2. Smoke Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.
3. Keys and Tools: One extra set for access to locked or tamperproofed components.
4. Audible and Visual Notification Appliances: One of each type installed.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level III technician.
- C. NFPA Certification: Obtain certification according to NFPA 72.

## 1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.
  1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
  2. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 SYSTEM DESCRIPTION

- A. Noncoded, UL-certified, non-proprietary addressable system, with multiplexed signal transmission and voice/strobe evacuation.
- B. Automatic sensitivity control of certain smoke detectors.
- C. All components provided shall be listed for use with the selected system.
- D. 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 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices:
  1. Manual stations.
  2. Heat detectors.
  3. Smoke detectors.
  4. Duct smoke detectors.
  5. Carbon monoxide detectors.
  6. Automatic sprinkler system water flow.
- B. Fire-alarm signal shall initiate the following actions:
  1. Continuously operate alarm notification appliances, including voice evacuation notices.
  2. Identify alarm and specific initiating device at fire-alarm control unit and remote annunciators.
  3. Unlock electric door locks in designated egress paths.
  4. Release fire and smoke doors held open by magnetic door holders.
  5. Activate voice/alarm communication system.
  6. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
  7. Close smoke dampers in air ducts of designated air-conditioning duct systems.
  8. Recall elevators to primary or alternate recall floors.
  9. Activate elevator power shunt trip.
  10. Activate emergency lighting control.
  11. Record events in the system memory.
  12. Record events by the fire alarm control panel stored memory.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
  1. Valve supervisory switch.

2. Elevator shunt-trip supervision.
3. Independent fire-detection and -suppression systems.
4. User disabling of zones or individual devices.
5. Loss of communication with any panel on the network.

- D. System trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
  2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
  3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
  4. Loss of primary power at fire-alarm control unit.
  5. Ground or a single break in internal circuits of fire-alarm control unit.
  6. Abnormal ac voltage at fire-alarm control unit.
  7. Break in standby battery circuitry.
  8. Failure of battery charging.
  9. Abnormal position of any switch at fire-alarm control unit or annunciator.
  10. Voice signal amplifier failure.
- E. System Supervisory Signal Actions:
1. Initiate notification appliances.
  2. Identify specific device initiating the event at fire-alarm control unit and remote annunciators.
  3. Record the event on internal memory of control panel.

## 2.3 FIRE-ALARM CONTROL UNIT

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Notifier.
  2. Edwards (United Technologies Corp).
- B. General Requirements for Fire-Alarm Control Unit:
1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.
    - a. System software and programs shall be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.
    - b. Include a real-time clock for time annotation of events on the event recorder.
    - c. Provide communication between the FACP and remote circuit interface panels, annunciators, and displays.
    - d. Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FACP shall provide a minimum 500-event history log.
  2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
  3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.
  4. **LCD screen with readout of alarms.**
- C. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
1. Annunciator and Display: Liquid-crystal type, 80 characters, minimum.
  2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.
- D. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:
1. Install no more than 50 addressable devices on each signaling-line circuit.
  2. Serial Interfaces:
    - a. One RS 485 port for remote annunciators, Ethernet module, or multi-interface module (printer port).
    - b. One USB or RS 232 port for PC configuration.
    - c. One RS 232 port for voice evacuation interface.
- E. Smoke-Alarm Verification:
1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.

2. Activate an approved "alarm-verification" sequence at fire-alarm control unit and detector.
  3. Record events by the fire alarm control unit.
  4. Sound general alarm if the alarm is verified.
  5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.
- F. Notification-Appliance Circuit:
1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
  2. Where notification appliances provide signals to sleeping areas, the alarm signal shall be a 520-Hz square wave with an intensity 15 dB above the average ambient sound level or 5 dB above the maximum sound level, or at least 75 dBA, whichever is greater, measured at the pillow.
  3. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.
- G. Elevator Recall:
1. Elevator recall shall be initiated only by one of the following alarm-initiating devices:
    - a. Elevator lobby detectors except the lobby detector on the designated floor.
    - b. Smoke detector in elevator machine room.
    - c. Smoke detectors in elevator hoistway.
  2. Elevator controller shall be programmed to move the cars to the alternate recall floor if lobby detectors located on the designated recall floors are activated.
  3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.
    - a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.
- H. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke-barrier walls shall be connected to fire-alarm system.
- I. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on fire alarm control unit LCD screen for read out.
- J. Voice/Alarm Signaling Service: Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided as a special module that is part of fire-alarm control unit.
1. Indicate number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the central-control microphone. Amplifiers shall comply with UL 1711.
    - a. Allow the application of, and evacuation signal to, indicated number of zones and, at the same time, allow voice paging to the other zones selectively or in any combination.
    - b. Programmable tone and message sequence selection.
    - c. Standard digitally recorded messages for "Evacuation" and "All Clear."
    - d. Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification-appliance circuits of fire-alarm control unit.
  2. Status Annunciator: Indicate the status of various voice/alarm speaker zones.
  3. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.
- K. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.
- L. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals and supervisory communicator transmitters shall be powered by 24-V dc source.
1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
- M. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
1. Batteries: Sealed lead calcium.

- N. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

## 2.4 MANUAL FIRE-ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
  2. Station Reset: Key- or wrench-operated switch.

## 2.5 SYSTEM SMOKE DETECTORS

- A. General Requirements for System Smoke Detectors:
1. Comply with UL 268; operating at 24-V dc, nominal.
  2. Detectors shall be four-wire type.
  3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
  4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
  5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
  6. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
  7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
    - a. Rate-of-rise temperature characteristic of combination smoke- and heat-detection units shall be selectable at fire-alarm control unit for 15 or 20 deg F per minute.
    - b. Fixed-temperature sensing characteristic of combination smoke- and heat-detection units shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 or 155 deg F.
    - c. Multiple levels of detection sensitivity for each sensor.
    - d. Sensitivity levels based on time of day.
- B. Photoelectric Smoke Detectors:
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
  2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
    - a. Primary status.
    - b. Device type.
    - c. Present average value.
    - d. Present sensitivity selected.
    - e. Sensor range (normal, dirty, etc.).
- C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.
1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
  2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
    - a. Primary status.
    - b. Device type.
    - c. Present average value.
    - d. Present sensitivity selected.
    - e. Sensor range (normal, dirty, etc.).
  3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
  4. Each sensor shall have multiple levels of detection sensitivity.
  5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
  6. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

## 2.6 CARBON MONOXIDE DETECTORS

- A. General: Carbon monoxide detector listed for connection to fire-alarm system.
  - 1. Mounting: Adapter plate for outlet box mounting.
  - 2. Testable by introducing test carbon monoxide into the sensing cell.
  - 3. Detector shall provide alarm contacts and trouble contacts.
  - 4. Detector shall send trouble alarm when nearing end-of-life, power supply problems, or internal faults.
  - 5. Comply with UL 2075.
  - 6. Locate, mount, and wire according to manufacturer's written instructions.
  - 7. Provide means for addressable connection to fire-alarm system.
  - 8. Test button simulates an alarm condition.

## 2.7 HEAT DETECTORS

- A. General Requirements for Heat Detectors: Comply with UL 521.
  - 1. Temperature sensors shall test for and communicate the sensitivity range of the device.
- B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.
  - 1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
  - 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
- C. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg.
  - 1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
  - 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

## 2.8 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Individually addressed, connected to a signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.
- B. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.
  - 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.
- C. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol. Provide weather proof rated horns where indicated.
- D. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch high letters on the lens.
  - 1. Rated Light Output:
    - a. 15/30/75/110 cd, selectable in the field.
  - 2. Mounting: Wall mounted unless otherwise indicated.
  - 3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
  - 4. Flashing shall be in a temporal pattern, synchronized with other units.
  - 5. Strobe Leads: Factory connected to screw terminals.
  - 6. Mounting Faceplate: Factory finished, red.
- E. Voice/Tone Notification Appliances:
  - 1. Comply with UL 1480.
  - 2. Speakers for Voice Notification: Locate speakers for voice notification to provide the intelligibility requirements of the "Notification Appliances" and "Emergency Communications Systems" chapters in NFPA 72.
  - 3. High-Range Units: Rated 2 to 15 W.
  - 4. Low-Range Units: Rated 1 to 2 W.
  - 5. Mounting: Surface mounted and bidirectional.

6. Matching Transformers: Tap range matched to acoustical environment of speaker location.

## 2.9 MAGNETIC DOOR HOLDERS

- A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.
  1. Electromagnets: Require no more than 3 W to develop 25-lbf holding force.
  2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
  3. Rating: 24-V ac or dc.
  4. Rating: 120-V ac.
- B. Material and Finish: Match door hardware.

## 2.10 REMOTE ANNUNCIATOR

- A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
  1. Mounting: Flush cabinet, NEMA 250, Type 1.
- B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

## 2.11 ADDRESSABLE INTERFACE DEVICE

- A. General:
  1. Include address-setting means on the module.
  2. Store an internal identifying code for control panel use to identify the module type.
  3. Listed for controlling HVAC fan motor controllers.
- B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.
- C. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall and to circuit-breaker shunt trip for power shutdown.
  1. Allow the control panel to switch the relay contacts on command.
  2. Have a minimum of two normally open and two normally closed contacts available for field wiring.
- D. Control Module:
  1. Operate notification devices.
  2. Operate solenoids for use in sprinkler service.

## 2.12 DEVICE GUARDS

- A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.
  1. Factory fabricated and furnished by device manufacturer.
  2. Finish: Paint of color to match the protected device.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.
  1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.
- B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
  - 1. Devices placed in service before all other trades have completed cleanup shall be replaced.
  - 2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.
- B. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.
- C. Manual Fire-Alarm Boxes:
  - 1. Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.
  - 2. Mount manual fire-alarm box on a background of a contrasting color.
  - 3. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above floor level. All devices shall be mounted at the same height unless otherwise indicated.
- D. Smoke- or Heat-Detector Spacing:
  - 1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
  - 2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
  - 3. Smooth ceiling spacing shall not exceed 30 feet.
  - 4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A in NFPA 72.
  - 5. HVAC: Locate detectors not closer than 36 inches from air-supply diffuser or return-air opening.
  - 6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.
- E. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.
- F. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches long shall be supported at both ends.
  - 1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.
- G. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Do not install smoke detectors in sprinklered elevator shafts.
- H. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.
- I. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.
- J. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling. Install all devices at the same height unless otherwise indicated.
- K. Device Location-Indicating Lights: Locate in public space near the device they monitor.

### 3.3 PATHWAYS

- A. Plenum rated cable shall be used for all pathways except where cabling is in conduit.
- B. Pathways above recessed accessible locations may be routed exposed.
- C. Pathways above inaccessible locations shall be installed in EMT.
- D. Pathways in exposed areas shall be routed in EMT and be painted red enamel.

- E. Pathways from main fire alarm control panel to each zone/building shall be routed underground to lower level mechanical or electrical room. Initial auxiliary panel(s) shall be located in these rooms. All cabling within the building zone shall be installed as specified above.

#### 3.4 ZONES

- A. Provide a fire alarm zone for each building that is identified on architectural code plans (CP Series). Fire alarm activation and notification by zone/building.

#### 3.5 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.
  - 1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
  - 1. Smoke dampers in air ducts of designated HVAC duct systems.
  - 2. Magnetically held-open doors.
  - 3. Electronically locked doors and access gates.
  - 4. Alarm-initiating connection to elevator recall system and components.
  - 5. Alarm-initiating connection to activate emergency lighting control.
  - 6. Supervisory connections at valve supervisory switches.
  - 7. Supervisory connections at elevator shunt-trip breaker.
  - 8. Supervisory connections at fire-extinguisher locations.
  - 9. Alarm-initiating connection to kitchen hood fire extinguishing system.
  - 10. Fire alarm system to be interfaced with intercommunications system to shunt audio from the intercom system when the fire alarm system is in an alarm condition. Provide fire alarm system with relay output for interface connections as required.

#### 3.6 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

#### 3.7 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.
- B. Ground shielded cables at the control panel location only. Insulate shield at device location.

#### 3.8 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by authorities having jurisdiction.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
- D. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Visual Inspection: Conduct visual inspection prior to testing.
    - a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.



- b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
  - 2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
  - 3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
  - 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
  - 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
  - 6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
- E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
  - F. Fire-alarm system will be considered defective if it does not pass tests and inspections.
  - G. Prepare test and inspection reports.
  - H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
  - I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

### 3.9 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
  - 1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
  - 2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
  - 3. Perform tests per the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

### 3.10 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.
- C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
  - 1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

### 3.11 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

## END OF SECTION 283111

