

# PROJECT MANUAL

## **Bank Iowa Clarinda**

**APMA Project No: 14131**

101 E MAIN STREET  
CLARINDA, Iowa 51632

**JANUARY 3, 2018**

**100% CONSTRUCTION DOCUMENTS**

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## SECTION 00 7000 - GENERAL CONDITIONS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. AIA Document A201, "General Conditions of the Contract for Construction," 2007 Edition, Articles 1 through 15 inclusive, as provided by The American Institute of Architects, are hereby made a part of the Contract Documents, except as hereinafter modified or supplemental in these specifications.
  - 1. The above document is hereinafter referred to in these specifications as the General Conditions.

### PART 2 - PRODUCTS

#### 2.1 MISCELLANEOUS ITEMS

- A. The General Conditions are hereby made a part of this Project Manual to the extent as if they were herein written out in full.
- B. A copy of the General Conditions is available for examination at the office of the Architect.
- C. The General Conditions are amended and modified in specification section entitled "Supplementary Conditions."

### PART 3 - EXECUTION (Not Used)

END OF SECTION 00 7000

## SECTION 00 7500 - SUPPLEMENTARY CONDITIONS

### 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. The Supplementary Conditions amend and modify AIA Document A201-2017 "General Conditions of the Contract for Construction" also known as the "General Conditions" described previously in these specifications. Where at variance with General Conditions, these Supplementary Conditions shall have preference. Where any Article of the General Conditions is modified or deleted by these Supplementary Conditions, the unaltered provisions, whether a portion of the Article, paragraph, subparagraph, or clause, shall remain in effect.

#### 1.3 DEFINITIONS

- A. Article. An individual portion of the General Conditions indicated with number headings and capitalized font (e.g. **ARTICLE 1 GENERAL PROVISIONS**).
- B. Paragraph. A distinct portion included under an Article within the General Conditions indicated with a paragraph mark (§) followed by the Article number and paragraph number in sequence and bold font (e.g. **§ 1.1 Basic Definitions**).
- C. Subparagraph. A lower-order paragraph indicated with a paragraph mark (§) followed by the Article number, paragraph number, and subparagraph number in sequence and bold font (e.g. **§ 1.1.1 The Contract Documents**) when the accompanying text is below the subparagraph title. When the accompanying text is inline with the number, then only the paragraph mark and numbering sequence is in bold font (e.g. **§ 1.2.1** The intent of the ...).
- D. Clause. A second-order paragraph indicated with a paragraph mark (§) followed by the Article number, paragraph number, subparagraph number, and clause number in sequence. The paragraph mark and the clause number is in bold font. The associated text is in regular font. (e.g. **§ 1.2.1.1** The invalidity of any ...).

PART 2 - MODIFICATIONS

2.1 Supplement Article 1 "General Provisions," Paragraph 1.1 "Basic Definitions" as follows:

A. Add Subparagraphs 1.1.9 and 1.1.10 as follows:

**§ 1.1.8 The Agreement**

The agreement which the successful bidder will be required to sign is AIA Document A101 - 2017 "Standard Form of Agreement Between Owner and Contractor" (or AIA Document A133 - 2009 "Standard Form of Agreement Between Owner and Construction Manager as Constructor") where the basis of payment is a stipulated sum (GMP), articles 1 through 10 inclusive, 8 pages, a standard form of the American Institute of Architects.

**§ 1.1.9 Furnish, Install or Provide**

Unless specifically limited in the context, the word "Furnish" or the word "Install" or the word "Provide" or any combination thereof, shall mean furnish and incorporate in the Work including all necessary labor, materials, equipment, and everything necessary to perform the work indicated.

2.2 Supplement Article 1 "General Provisions," Paragraph 1.5 "Ownership and Use of Drawings, Specifications, and Other Instruments of Service" as follows:

A. Add Subparagraph 1.5.3:

**§ 1.5.3** All Drawings and photographs of Drawings including those used for publicity purposes are instruments of service, the property of Alley Poyner Macchietto Architecture, Inc., Omaha, Nebraska and may not be reproduced without their permission. The reproduction shall carry their name as Architect.

2.3 Supplement Article 2 "Owner," Paragraph 2.2 "Evidence of the Owner's Financial Arrangements" as follows:

A. Add Subparagraph 2.2.5:

**§ 2.2.5** Unless otherwise provided in the Contract Documents, the Contractor will be furnished, free of charge, up to ten (10) copies of Drawings and Project Manuals for execution of the Work.

2.4 Supplement Article 3 "Contractor," Paragraph 3.3 "Supervision and Construction Procedures" as follows:

A. Add Subparagraph 3.3.4:

**§ 3.3.4 Site Layout**

The Contractor shall be responsible for the correct layout to line, level and dimension of all work as shown on the Drawings. He shall notify the Architect of any discrepancy that may exist between site conditions and the Drawings and shall obtain written instructions from the Architect before proceeding with this work.

2.5 Supplement Article 3 "Contractor," Paragraph 3.5 "Warranty" as follows:

A. Add Subparagraph 3.5.3:

**§ 3.5.3** The Prime Contractor shall, in case of work performed by his subcontractors and where guarantees are required, secure warranties from said subcontractors and deliver copies of same to the Architect upon completion of the work.

2.6 Supplement Article 3 "Contractor," Paragraph 3.7 "Permits, Fees, Notices and Compliance with Laws" as follows:

A. After the last sentence, add the following: "Capital facility fees, if required, shall be paid by the Owner."

2.7 Supplement Article 3 "Contractor," Paragraph 3.10 "Contractor's Construction and Submittal Schedules" as follows:

A. Add Clause 3.10.1.1:

**§ 3.10.1.1** The Contractor shall review the construction schedule and progress of the work at least weekly and shall update the schedule at least monthly. Schedules shall be available for the Owner's and Architect's review at all times.

2.8 Supplement Article 3 "Contractor," Paragraph 3.11 "Documents and Samples at the Site" as follows:

A. Add Subparagraph 3.11.1:

**§ 3.11.1** The Contractor shall maintain at their home office a second set of the as-built drawings. These drawings shall be kept up to date and be equal to the drawings required at the job site.

2.9 Supplement Article 3 "Contractor," Paragraph 3.15 "Cleaning Up" as follows:

A. Add Subparagraph 3.15.3 and Clauses 3.15.3.1 and 3.15.3.2:

**§ 3.15.3** Special Cleaning: Besides the general floor cleaning, the Prime (General) Contractor shall do the following special cleaning for all trades at completion of Work:

**§ 3.15.3.1** Cleaning of all fixtures and equipment furnished under these Specifications: All fixtures and equipment shall be cleaned of all stains, paint, dirt and rust.

**§ 3.15.3.2** Cleaning of all windows and glass surfaces, both interior and exterior, and all other items having dust, dirt or other foreign material on them.

2.10 Modify and Supplement Article 7 "Changes in the Work," Paragraph 7.3 "Construction Change Directives" as follows:

- A. Modify Subparagraph 7.3.4: Delete "or if no such amount is set forth in the Agreement, a reasonable allowance" and substitute "the following fixed percentages" are substituted therefore.
- B. Add paragraph 7.3.11:

**§ 7.3.11** The maximum percentages which shall be allowed for Contractor and Subcontractor combined overhead and profit shall be as follows: For the Subcontractor, 10% of the net extra cost of work he performs; For the Contractor, 5% of the net extra cost and profit of the work performed by subcontractor; For the Contractor, 10% of the net extra cost of the work he performs with his own forces.

2.11 Supplement Article 9 "Payments and Completion," Paragraph 9.3 "Applications for Payment" as follows:

- A. Paragraph 9.3.1, after the last sentence, add the following: "In applying for payments the Prime Contractor shall submit three copies of a statement to the Architect showing the value of his material and labor satisfactorily incorporated in the building and acceptable material or equipment suitably stored at the site. Originals of the current editions of AIA Documents Numbers G702 and G703 shall be used for the applications for payment."
- B. Paragraph 9.3.2, after the last sentence, add the following: "Materials stored off-site shall be included in the Application for Payment only if accompanied by substantial documentation."
- C. Add Subparagraphs 9.3.4, 9.3.5 and 9.3.6:

**§ 9.3.4** Ten percent (10%) of the value of the work in place and materials suitably stored on the site, or at some other fully insured location, will be retained from each progress payment until the project is complete. The total sum retained shall be paid to the Contractor upon final completion of the Work as called for in Subparagraphs 9.9.1 and 9.9.2.

**§ 9.3.5** Before the first application for payment is approved, the Prime Contractor shall have submitted an acceptable progress schedule.

**§ 9.3.6** An updated construction schedule indicating current progress in the work and proposed scheduling for completing the Work by the completion date shall be submitted with each monthly application for payment.



2.12 Supplement Article 9 "Payments and Completion," Paragraph 9.10 "Final Completion and Final Payment" as follows:

A. Add Subparagraph 9.10.6:

**§ 9.10.6** The following additional documents shall be furnished to the Owner prior to the final payment becoming due: Signed letter setting date of completion of specific guarantees; Guarantee Certificates for construction materials, etc., for periods specified in appropriate sections of these Specifications; Operating Manuals, Parts Lists and Equipment Drawings; All other items indicated in Section 01700, Project Closeout.

2.13 Supplement Article 10 "Protection of Persons and Property," Paragraph 10.1 "Safety Precautions and Programs" as follows:

A. Add Subparagraphs 10.1.1:

**§ 10.1.1** The Contractor shall have sole responsibility for safety of persons and property, and for compliance with OSHA and/or other governing parties.

2.14 Modify and Supplement Article 11 "Insurance and Bonds," Paragraph 11.1 "Contractor's Insurance and Bonds," as follows:

A. Delete Subparagraph 11.1.2 and replace with the following:

**§ 11.1.2** Insurance required by 11.1.1 shall be written for not less than the limits of liability specified herein or required by law, whichever is greater, however by requiring insurance Owner does not represent that the coverage and limits required will necessarily be adequate to protect the Contractor's interest in the work. Coverage shall be maintained without interruption from the date of commencement of the work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction of work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents. Such coverage and limits shall not be deemed or construed to be any limitation on the Contractor's liabilities under any indemnification obligations provided to Owner under this contract.

B. Add new Clause 11.1.2.1 as follows:

**§ 11.1.2.1** The insurance required by 11.1.1 shall be as follows:

1. Workers' Compensation: Statutory coverage for the state where the work is being performed. Employers' Liability Insurance with minimum limits shown below:

Bodily injury by accident	\$500,000 each accident
Bodily injury by disease	\$500,000 each accident
Bodily injury by disease	\$500,000 policy limit

USL&H and/or Jones Act coverage shall be provided where applicable.

2. Commercial General Liability Insurance, which shall be no less comprehensive and no more restrictive than coverage provided by a standard form Commercial General Liability Policy (ISO CG0001) with minimum limits shown below covering bodily injury, property damage including loss of use and personal and advertising injury:

General Aggregate Limit	\$2,000,000
Products Completed Operations Aggregate Limit	\$2,000,000
Personal and Advertising Injury Limit	\$1,000,000
Each Occurrence Limit	\$1,000,000
Fire Damage Limit (any one fire)	\$ 50,000
Medical Damage Limit (any one person)	\$ 5,000

This insurance must include the following features:

- a. Coverage shall be on an occurrence form and not claims made.
  - b. Coverage for all premises and operations.
  - c. The General Aggregate limit shall apply on a Per Project basis.
  - d. Operations by independent contractors.
  - e. If work to be performed by Contractor includes construction or demolition operations within 50 feet of any railroad property and affecting any railroad bridge or trestle, tracks, road beds, tunnel, underpass, or crossing, then such policy will include coverage for work done within 50 feet of a railroad right of way.
  - f. Policy shall not exclude coverage for XCU (explosion, collapse, underground)
  - g. Policy shall not contain a total or absolute pollution exclusion. Coverage shall be provided for pollution exposures arising from products and completed operations. (As per standard CG0001 Pollution Exclusion or equivalent.)
  - h. Products and completed operations shall be maintained for duration of work, and shall be further maintained for a minimum period of two (2) years after final acceptance and payment, unless modified in the Special Provisions.
  - i. Contractual liability coverage shall be included and shall not be amended by any limiting endorsements. Defense costs shall be in addition to policy limits.
  - j. Completed Operations shall provide coverage for work performed by subcontractors.
  - k. If applicable, coverage for EIFS-related work shall be included.
3. Commercial Auto Liability Insurance, which shall be at least as broad as and no less restrictive than ISO form CA 0001, covering all owned, non-owned, hired and leased vehicles with a minimum combined single limit for bodily injury and property damage of \$1,000,000 per accident. Insurance must include contractual liability coverage. If applicable, policy shall provide auto cargo pollution endorsement (ISO CA 99 48, or equivalent). If work to be performed by Contractor includes construction or demolition operations within 50 feet of any railroad property and affecting any railroad bridge or trestle, tracks, road beds, tunnel, underpass, or crossing, then such policy will include coverage for work done within 50 feet of a railroad right of way.

4. Umbrella/Excess Insurance: Policy shall provide liability coverage in excess of the specified Employers Liability, Commercial General Liability, and Commercial Auto Liability with limits of at least \$ 5,000,000 per occurrence and aggregate.

C. Delete Subparagraph 11.1.3 and replace with the following:

**§ 11.1.3** Certificates of insurance acceptable to the Owner, and executed by a licensed representative of the participating insurer, shall be filed with the Owner and Architect prior to commencement of the work and thereafter upon renewal or replacement of each required policy of insurance. If required by Owner, copies of endorsement and/or policies shall be provided. Contractor shall promptly notify Owner of any cancellation, non-renewal, reduction of limits, or material modification of any policies of insurance required by this agreement. Contractor shall cause all policies of insurance to be endorsed to provide Owner 30 days' notice prior to cancellation (10 days for non-payment of premium). An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Failure of Owner to demand such certificate(s) or other evidence of full compliance with these insurance requirements or failure of Owner to identify any deficiency from evidence provided by Contractor shall not be construed as a waiver of Contractor's obligation to maintain such insurance.

D. Delete Subparagraph 11.1.4 and replace with the following:

**§ 11.1.4** The Contractor shall cause the commercial general liability and Umbrella policies required by the contract documents to include on a primary and non-contributory basis (1) the Owner as additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the contractor's operations; (2) the Owner as additional insured for Completed Operations for 2 years following substantial completion for claims caused in whole or in part by the Contractor's negligent acts or omissions; (3) the Architect and Architect's Consultants as additional insured using ISO Form CG 2032 0704 or equivalent; (4) other parties as identified by Owner through special supplemental conditions.

E. Add new Subparagraph 11.1.5:

**§ 11.1.5** Contractor waives all rights of subrogation against Owner, Architect and Architect's Consultants and shall cause its insurers for Commercial General Liability, Workers Compensation, Auto Liability, and Umbrella Liability to endorse said policies to waive all rights of subrogation against Owner, Architect and Architect's Consultants with respect to losses arising out of or in connection with the Work.

F. Add new Subparagraph 11.1.6

**§ 11.1.6** Contractor shall require all subcontractors to comply with the terms and conditions set forth within section 11.1.

2.15 Modify Article 11 "Insurance and Bonds," Paragraph 11.3 "Waivers of Subrogation," as follows:

A. Modify Subparagraph 11.3.1 as follows:

1. Delete "Unless otherwise provided, the Owner" and substitute "Unless otherwise provided, the Contractor."
2. Delete "This insurance shall include interests of the Owner, the Contractor, Subcontractors, and Sub-subcontractors in the project" and substitute "This insurance shall include as named insureds the Owner, the Contractor, and all tiers of Subcontractors."

B. Delete Clause 11.3.1.2 in its entirety.

C. Delete Clause 11.3.1.3 and replace with the following:

**§ 11.3.1.3** If the property insurance requires deductibles, the Contractor shall pay costs not covered because of such deductibles.

D. Delete Clause 11.3.1.5 and replace with the following:

**§ 11.3.1.5** The property insurance provided by Contractor pursuant to 11.3 shall be endorsed to allow for partial occupancy or use in accordance with Section 9.9. Evidence of which shall be provided in accordance with section 11.3.6.

E. Delete Subparagraph 11.3.2 and replace with the following:

**§ 11.3.2** The Contractor shall purchase and maintain mechanical breakdown coverage in association with the property insurance as required by 11.3.1 which shall specifically cover such insured objects during installation and until final acceptance by the Owner.

F. Delete Subparagraph 11.3.3 and replace with the following:

**§ 11.3.3** The Owner, at the Owner's option, may require through special supplemental conditions, the Contractor to purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards included in, or required to be included in, property insurance in accordance with section 11.3. The Owner waives all rights of action against the Contractor for loss of use of the Owner's property, including consequential losses due to fire or other hazards however caused.

G. Modify Subparagraph 11.3.4 as follows:

1. Replace "Contractor" with "Owner" and replace "Owner" with "Contractor."

H. Modify Subparagraph 11.3.6 as follows:

1. Replace "Owner" with "Contractor" and replace "Contractor" with "Owner."

- I. Modify Subparagraph 11.3.8 as follows:
  1. Delete "A loss insured under the Owner's property insurance" and replace with "A loss insured under the Contractor's property insurance."
- 2.16 Supplement Article 12 "Uncovering and Correction of Work," Paragraph 12.2 "Correction of Work," Subparagraph 12.2.2 "After Substantial Completion" as follows:
  - A. Add Clause 12.2.2.6:

**§ 12.2.2.6** The Prime Contractor shall and does hereby guarantee the following in respect to all work performed by his or her subcontractors. For a period of one year from the date of substantial completion and longer if so written in any of the sections, all movable or adjustable work shall remain in perfect working order, including hardware, weatherstripping, doors, apparatus, and all other equipment to which this heading is applicable. Nothing in the above intends or implies that this guaranty shall apply to work which has been abused or neglected by the Owner or his successor in interest. Where guarantees or warranties are written in any of the Sections for longer terms, such longer terms shall apply.
- 2.17 Supplement Article 13 "Miscellaneous Provisions" as follows:
  - A. Add Paragraph 13.6:

**§13.6 Payment to Unemployment Compensation Fund**  
Payment to Unemployment Compensation Fund: The Contractor will pay to the Unemployment Compensation Fund of the State in which the project is located Unemployment Contributions and interest due on wages paid to individuals employed in the performance of this contract.
  - B. Add Paragraph 13.7 and Subparagraphs 13.7.1 and 13.7.2:

**§ 13.7** Construction Meetings: The Contractor shall arrange the following minimum number of meetings with subcontractors, suppliers and others as needed to coordinate and construct the work in a timely and sufficient manner.

**§ 13.7.1** Preconstruction Meeting: Before the start of construction on the project this meeting shall be held to discuss procedural and other items relative to start of work. The Contractor and at least all major subcontractors shall attend. The Architect will conduct this meeting.

**§ 13.7.2** Construction Meetings: The Contractor shall conduct weekly construction meetings throughout the entire contract time for construction. A representative from each company working on the project, or about to do work, and one that has authority to make decisions for the company shall attend these meetings. The Owner's representative and Architect shall have the right to attend any, or all, of these meetings.

2.18 Supplement Article 15 "Claims and Disputes," Paragraph 15.1 "Claims" as follows:

A. Add Subparagraph 15.1.4 and Clause 15.1.4.1:

**§ 15.1.4 Claims for Additional Time**

The procedure for determination of time extensions for unusually severe weather shall be as set forth as follows. The following listing defines monthly anticipated adverse weather for the Contract period.

**§ 15.1.4.1** Contractor's schedule must reflect these anticipated adverse weather delays in all weather dependent activities.

MONTHLY ANTICIPATED ADVERSE WEATHER CALENDAR DAYS											
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
(08)	(05)	(03)	(04)	(06)	(04)	(05)	(05)	(03)	(02)	(03)	(06)

The schedule above will constitute the base line for monthly, or a portion thereof, weather time evaluations. Upon acknowledgment of Notice to Proceed and continuing throughout the Contract, on a monthly basis, actual adverse weather days will be recorded on a calendar day basis (including weekends and holidays) and compared to the monthly anticipated adverse weather schedule, above. The term "actual adverse weather days" shall include days impacted by adverse weather. The number of actual adverse weather days shall be calculated chronologically from the first to the last day in each month. Once the number of actual adverse weather days anticipated in schedule above has been exceeded, Owner will examine all actual adverse weather days to determine whether Contractor is entitled to a time extension. These actual adverse weather days must prevent 50 percent or more of Contractor's workday, delay Work critical to timely completion of the Project, and be documented in Contractor Quality Control reports. Owner will convert any delays meeting these requirements to calendar days and issue a Change Order to Contractor.

END OF SECTION 00 7500

## SECTION 01 1000 - SUMMARY

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Project information.
  - 2. Work covered by Contract Documents.
  - 3. Owner-furnished products.
  - 4. Contractor-furnished, Owner-installed products.
  - 5. Access to site.
  - 6. Work restrictions.
  - 7. Specification and Drawing conventions.
- B. Related Requirements:
  - 1. Section 01 5000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

#### 1.3 PROJECT INFORMATION

- A. Project Identification: Bank Iowa Clarinda; Project No. 14131.
  - 1. Project Location: 101 E Main Street, Clarinda, Iowa, 51632.
- B. Owner: Bank Iowa, 1150 Jordon Creek Parkway, West Des Moines, Iowa, 50266.
- C. Architect: Alley Poyner Macchietto Architecture Incorporated, 1516 Cuming Street, Omaha, Nebraska, 68102.
- D. Architect's Consultants: Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:
  - 1. Civil Engineering: McClure Engineering Co., Red Oak, Iowa.
  - 2. Structural Engineering: Thompson Dreessen & Dörner, Inc., Omaha, Nebraska.
  - 3. Mechanical Engineering: Engineering Technologies, Inc., Omaha, Nebraska.
  - 4. Electrical Engineering: Engineering Technologies, Inc., Omaha, Nebraska.
- E. Contractor: Lund Ross Constructors has been engaged as Contractor for this Project.

- F. Web-Based Project Software: Project software administered by Contractor will be used for purposes of managing communication and documents during the construction stage.

- 1. See Section 01 3100 "Project Management and Coordination." for requirements for establishing, administering, and using web-based Project software.

#### 1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:

- 1. Renovation of Historic Bank Building and new construction infill at previously demolished structures and other Work indicated in the Contract Documents.

- B. Type of Contract:

- 1. Project will be constructed under a single prime contract.

#### 1.5 OWNER-FURNISHED PRODUCTS

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

#### 1.6 ACCESS TO SITE

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

- B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

- 1. 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 for storage of materials.
    - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
    - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

- 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.



- D. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

#### 1.7 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. Nonsmoking Building: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.
- C. Restricted Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

#### 1.8 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 1000

## SECTION 01 2100 - ALLOWANCES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements governing allowances.
- B. Types of allowances include the following:
  - 1. Lump-sum allowances.

#### 1.3 DEFINITIONS

- A. Allowance is a quantity of work or dollar amount established in lieu of additional requirements, used 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.

#### 1.4 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection, or purchase and delivery, of each product or system described by an allowance must be completed by the Owner 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.

#### 1.5 ACTION SUBMITTALS

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

#### 1.6 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.

#### 1.7 LUMP-SUM 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.
- 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 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.

#### 1.8 QUANTITY 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.
- 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 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.

#### 1.9 TESTING AND INSPECTING ALLOWANCES

- A. Testing and inspecting allowances include the cost of engaging testing agencies, actual tests and inspections, and reporting results.

- B. The allowance does not include incidental labor required to assist the testing agency or costs for retesting if previous tests and inspections result in failure. The cost for incidental labor to assist the testing agency shall be included in the Contract Sum.
- C. Costs of testing and inspection services not required by the Contract Documents are not included in the allowance.
- D. At Project closeout, credit unused amounts remaining in the testing and inspecting allowance to Owner by Change Order.

## 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. Allowance No. 1: Landscape, \$10,000.00.

END OF SECTION 01 2100

## SECTION 01 2300 - ALTERNATES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for alternates.

#### 1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
  - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
  - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

#### 1.4 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
  - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Execute accepted alternates under the same conditions as other work of the Contract.
- C. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. Alternate No. 1: 240 SY, 6" PCC pavement per sheet C1.5.

END OF SECTION 01 2300

## SECTION 01 2600 - CONTRACT MODIFICATION PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Requirements:
  - 1. Section 01 2500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

#### 1.3 MINOR CHANGES IN THE WORK

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

#### 1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
  - 1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
  - 2. Within time specified in Proposal Request or 20 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
    - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    - c. Include costs of labor and supervision directly attributable to the change.

- d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
  - e. Quotation Form: Use forms acceptable to Architect.
- B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.
  - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
  - 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
  - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
  - 4. Include costs of labor and supervision directly attributable to the change.
  - 5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
  - 6. Comply with requirements in Section 01 2500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
  - 7. Proposal Request Form: Use form acceptable to Architect.

#### 1.5 CHANGE ORDER PROCEDURES

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

#### 1.6 CONSTRUCTION CHANGE DIRECTIVE

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



PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2600

## SECTION 01 2900 - PAYMENT PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
  - 1. Section 01 2600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.

#### 1.3 DEFINITIONS

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

#### 1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
  - 1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
    - a. Application for Payment forms with Continuation Sheets.
    - b. Submittals Schedule.
  - 2. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
  - 3. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
1. Identification: Include the following Project identification on the schedule of values:
    - a. Project name and location.
    - b. Name of Architect.
    - c. Architect's Project number.
    - d. Contractor's name and address.
    - e. Date of submittal.
  2. Arrange the schedule of values in tabular form, with separate columns to indicate the following for each item listed:
    - a. Related Specification Section or Division.
    - b. Description of the Work.
    - c. Change Orders (numbers) that affect value.
    - d. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent. Round dollar amounts to whole dollars, with total equal to Contract Sum.
  3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual Table of Contents. Provide multiple line items for principal subcontract amounts where appropriate.
  4. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
    - a. Differentiate between items stored on-site and items stored off-site.
    - b. Provide evidence of insurance or bonded warehousing for items stored off-site.
  5. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
  6. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
    - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.
  7. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

## 1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
  - 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
  - 2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
  - 1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
  - 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
  - 3. Provide summary documentation for stored materials indicating the following:
    - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect . One copy shall include waivers of lien and similar attachments if required.
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
  - 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.

2. When an application shows completion of an item, submit conditional final or full waivers.
  3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
  2. Schedule of values.
  3. Contractor's construction schedule (preliminary if not final).
- I. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
  2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
  2. AIA Document G706.
  3. AIA Document G706A.
  4. AIA Document G707.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 2900

## SECTION 01 3100 - PROJECT MANAGEMENT AND COORDINATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
  - 1. General coordination procedures.
  - 2. Coordination drawings.
  - 3. RFIs.
  - 4. Digital project management procedures.
  - 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 01 7300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
  - 2. Section 01 7700 "Closeout Procedures" for coordinating closeout of the Contract.

#### 1.3 DEFINITIONS

- A. BIM: Building Information Modeling.
- B. RFI: Request for Information. Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
  - 1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
  - 2. Number and title of related Specification Section(s) covered by subcontract.

3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses 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.

1. Post copies of list in project meeting room, in temporary field office, in web-based Project software directory, and in prominent location in each built facility. Keep list current at all times.

#### 1.5 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and scheduled 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. Delivery and processing of submittals.
3. Progress meetings.
4. Preinstallation conferences.
5. Project closeout activities.
6. Startup and adjustment of systems.

#### 1.6 REQUEST FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect will return without response those RFIs submitted to Architect by other entities controlled by Contractor.
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. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
  - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: Form acceptable to Architect.

1. Attachments shall be electronic files in PDF format.

D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:
  - a. Requests for approval of submittals.
  - b. Requests for approval of substitutions.
  - c. Requests for coordination information already indicated in the Contract Documents.
  - d. Requests for adjustments in the Contract Time or the Contract Sum.
  - e. Requests for interpretation of Architect's actions on submittals.
  - f. 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 by Architect 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 01 2600 "Contract Modification Procedures."
  - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 7 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. Use software log that is part of web-based Project software with not less than the following:
  - 1. Project name.
  - 2. Name and address of Contractor.
  - 3. Name and address of Architect.
  - 4. RFI number including RFIs that were returned without action or withdrawn.
  - 5. RFI description.
  - 6. Date the RFI was submitted.
  - 7. Date Architect's response was received.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven days if Contractor disagrees with response.

## 1.7 DIGITAL PROJECT MANAGEMENT PROCEDURES

- A. Architect's Data Files Not Available: Architect will not provide Architect's BIM model/digital data files for Contractor's use during construction.
- B. Web-Based Project Software: Provide, administer, and use web-based Project software site for purposes of hosting and managing Project communication and documentation until Final Completion.
  - 1. Provide the following web-based Project software packages under their current published licensing agreements:
    - a. Oracle Primavera Submittal Exchange.
- C. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare 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.
  - 3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

## 1.8 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
  - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times a minimum of 10 working days prior to meeting.

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 and Architect, within three days of the meeting.
- B. Preconstruction Conference: Architect 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. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Communication - Chain of Command.
      - 1) Progress/Coordination meetings.
      - 2) Pre-installation & startup.
      - 3) Use of web-based Project software (i.e. Submittal Exchange).
    - b. Scope of Work - Design Intent / Contract Document Review.
      - 1) Brief explanation of design & special features.
      - 2) Specifications, drawings, addenda, errors, inconsistencies, omissions.
      - 3) Means & Methods - Contractor's sole prerogative.
    - c. Jobsite Requirements - Project Limits / Superintendent / Staging / Noise & Dust / OSHA.
      - 1) Existing condition of site - review with Owner & A/E.
      - 2) Contractor's ownership of job site within project limits.
      - 3) Superintendent on site.
      - 4) Site access - keys, passes, badges.
      - 5) Job trailer, signs, parking, fencing.
      - 6) Deliveries, material disposal, salvage.
      - 7) Owner-furnished materials, delivery, coordination.
      - 8) Hazardous materials.
      - 9) Utility locates.
      - 10) Respect Users.
      - 11) Safety on site - Contractor's responsibility.
    - d. Scope of Work - Project Schedule / Construction Coordination Requirements.
      - 1) Contract dates.
      - 2) Hours of operation.
      - 3) Utility outages.
      - 4) Occupant, material, equipment moves - notification requirements.

- e. Inspections - Quality Control / Record Keeping / Testing.
  - 1) Site inspections, A/E project visits.
  - 2) Unacceptable work.
  - 3) Maintaining as-built conditions.
  - 4) Daily logs.
  - 5) Testing - types, reports, payments.
- f. Submittals - Shop Drawings / State Forms.
  - 1) State forms: [architecture.mt.gov/forms/standardforms.asp](http://architecture.mt.gov/forms/standardforms.asp).
  - 2) Submittal schedule.
  - 3) Substitutions, long lead/special items.
  - 4) Submission method, quantities, response time, format.
- g. Request for Information - Contract Modification Procedures.
  - 1) RFIs, RFI log, response time.
    - a) Change Procedure: RFI - Approval from A/E - Contractor or Architect Cost Proposal - Construction Change Directive - Change Order - Meeting to review/discuss proposals.
- h. Request for Payment.
  - 1) In conjunction with first pay request:
    - a) Schedule.
    - b) Schedule of Values.
    - c) List of Subcontractors & Suppliers.
  - 2) Number of copies.
  - 3) Updated schedule.
  - 4) Stored materials, lien release.
  - 5) Review at monthly progress meetings.
- i. Substantial Completion - Warranties / Training.
  - 1) Contract obligations.
  - 2) Formal notification by Contractor.
  - 3) Punchlists, completion expectations.
  - 4) Warranties.
  - 5) Training schedules, agenda.
  - 6) O&M Manuals.
  - 7) As-Built Drawings.
- j. Final Acceptance - Closeout.
  - 1) Contract obligations, Consent of Surety and Contractor's Affidavit.
  - 2) Final pay request.
  - 3) Final inspection.

- k. Facility Use Concerns.
- 3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Progress Meetings: Conduct progress meetings at weekly intervals.
  - 1. 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.
  - 2. 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 3100

## SECTION 01 3300 - SUBMITTAL PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Submittal schedule requirements.
  - 2. Administrative and procedural requirements for submittals.
    - a. An Alley Poyner Macchietto Architecture, Inc. shop drawing transmittal form is attached to this Project Manual following this Section.
- B. Related Requirements:
  - 1. Section 01 2900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
  - 2. Section 01 3100 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
  - 3. Section 01 4000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
  - 4. Section 01 7700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
  - 5. Section 01 7823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
  - 6. Section 01 7900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

#### 1.3 DEFINITIONS

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

#### 1.4 SUBMITTAL FORMATS

- A. Submittal Information: Include the following information in each submittal:
1. Project name.
  2. Date.
  3. Name of Architect.
  4. Name of Contractor.
  5. Names of manufacturer.
  6. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
  7. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
  8. Drawing number and detail references, as appropriate.
  9. Other necessary identification.
- B. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
- C. PDF Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.
- D. Submittals for Web-Based Project Software: Prepare submittals as PDF files, or other format indicated by Project software website.

#### 1.5 SUBMITTAL PROCEDURES

- A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
1. Web-Based Project Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
- 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. Coordinate transmittal of submittals for related parts of the Work specified in different Sections so processing will not be delayed because of need to review submittals concurrently for coordination.
    - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
  2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
  3. Resubmittal Review: Allow 15 days for review of each resubmittal.

#### 1.6 SUBMITTAL REQUIREMENTS

- A. 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 unsuitable for use, submit as Shop Drawings, not as Product Data.
  2. Mark each copy of each submittal to show which products and options are applicable.
  3. Include the following information, as applicable:
    - a. Manufacturer's catalog cuts.
    - b. Manufacturer's product specifications.
    - c. Standard color charts.
    - d. Application of testing agency labels and seals.
- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    - a. Identification of products.
    - b. Compliance with specified standards.
    - c. Notation of coordination requirements.
    - d. Notation of dimensions established by field measurement.
    - e. Relationship and attachment to adjoining construction clearly indicated.
    - f. Seal and signature of professional engineer if specified.
  2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
  3. Paper 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.

- C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.
1. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
    - a. Number of Samples: Submit one full set(s) 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.
  2. 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. If variation in color, pattern, texture, or other characteristic is inherent in the product represented by a Sample, submit at least three sets of paired units that show approximate limits of the variations.
    - b. Refer to individual Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
  3. Provide and submit corresponding electronic submittal of Sample transmittal by use of digital image file(s) illustrating Sample characteristics and identification information via Web-based Project Software.
  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 not incorporated into the Work, or otherwise designated as Owner's property, are the property of the Contractor.

#### 1.7 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 insufficient to perform services or certification required, submit a written request for additional information to Architect.



## 1.8 CONTRACTOR'S REVIEW

- A. Action Submittals 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. Contractor's Approval: Indicate Contractor's approval for each submittal with indication in web-based Project software. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
  - 1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

## 1.9 ARCHITECT'S REVIEW

- A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return it.
  - 1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action, as follows:
    - a. "A" - REVIEWED, NO EXCEPTIONS TAKEN.
    - b. "B" - REVIEWED, EXCEPTIONS TAKEN AS NOTED.
    - c. "C" - DISAPPROVED, RESUBMISSION IS REQUIRED.
    - d. "D" - INCOMPLETE TRANSMITTAL, PLEASE RESUBMIT.
    - e. "E" - NO ACTION TAKEN.
  - 2. Submittals by Web-Based Project Software: Architect will indicate, on Project software website, the appropriate action.
    - a. "A" - REVIEWED, NO EXCEPTIONS TAKEN.
    - b. "B" - REVIEWED, EXCEPTIONS TAKEN AS NOTED.
    - c. "C" - REVIEWED - REVISE & RESUBMIT.
    - d. "D" - RECEIPT ACKNOWLEDGED - NO ACTION TAKEN.
- B. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 3300

Project: \_\_\_\_\_  
 APMA Project No. \_\_\_\_\_  
 To: Alley Poyner Macchietto Architecture, Inc.  
 1516 Cuming Street  
 Omaha, NE 68102  
 Owner: \_\_\_\_\_  
 Contractor: \_\_\_\_\_

Transmittal No. \_\_\_\_\_  
 First Submittal: \_\_\_\_\_  
 Resubmitting: \_\_\_\_\_  
 Shop Drawing: \_\_\_\_\_  
 Other: \_\_\_\_\_

Contractor Statement: "These submittals have been reviewed by this Contractor. All field measurements, field construction criteria, materials, catalogue numbers, and similar data have been checked and coordinated with the requirements of the Work, the contract documents and the work of other contractors."

Notice to Contractors: If any submittal deviates from the Contract Documents, the Contractor shall advise the Architect of the deviations in writing accompanying the submittal, including the reasons for the deviations.

Contractor's Signature: \_\_\_\_\_ Date: \_\_\_\_\_

SUBMITTAL		DESCRIPTION		ACTION TAKEN					COPIES TO			
SECT.#	QTY	MFGR/SUPPLIER	ITEM	A	B	C	D	E	O	A	E	C

ACTION TAKEN

A – Reviewed, no exception taken  
 B – Reviewed, exceptions taken as noted  
 C – Disapproved, Resubmission is required  
 D – Incomplete transmittal, Please Resubmit  
 E – No Action Taken

DISTRIBUTION LEGEND

O – Owner  
 A – Architect  
 E – Engineer  
 C – Contractor

INSTRUCTIONS TO ENGINEER/CONSULTANT:

Items # \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_ are being transmitted for your review. Please note the action taken on each of the submittals and complete, sign, date and return this transmittal form. Please return within 7 working days from date received.

CONSULTANT: \_\_\_\_\_

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

COMMENTS:

ALLEY POYNER MACCHIETTO ARCHITECTURE, Inc.:

\_\_\_\_\_

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

## SECTION 01 3591 - HISTORIC TREATMENT PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes general protection and treatment procedures for entire Project and the following specific work:
  - 1. Historic removal and dismantling.
- B. Related Requirements:
  - 1. Section 04 0120 "Maintenance of Unit Masonry" for specific requirements for cleaning and repairing clay masonry.
  - 2. Section 04 0140 "Maintenance of Stone Assemblies" for specific requirements for cleaning and repairing stone.
  - 3. Section 08 0152.93 "Historic Treatment of Wood Windows" for specific requirements for cleaning and repairing wood windows.

#### 1.3 DEFINITIONS

- A. Consolidate: To strengthen loose or deteriorated materials in place.
- B. Dismantle: To disassemble and detach items by hand from existing construction to the limits indicated, using small hand tools and small one-hand power tools, so as to protect nearby historic surfaces; and legally dispose of dismantled items off-site, unless indicated to be salvaged or reinstalled.
- C. Existing to Remain: Existing items that are not to be removed or dismantled.
- D. Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Architect.
- E. Reconstruct: To remove existing item, replicate damaged or missing components, and reinstall in original position.
- F. Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.

- G. Reinstall: To protect removed or dismantled item, repair and clean it as indicated for reuse, and reinstall it in original position, or where indicated.
  - H. Remove: Specifically for historic spaces, areas, rooms, and surfaces, the term means to detach an item from existing construction to the limits indicated, using hand tools and hand-operated power equipment, and legally dispose of it off-site, unless indicated to be salvaged or reinstalled.
  - I. Repair: To correct damage and defects, retaining existing materials, features, and finishes while employing as little new material as possible. Includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.
  - J. Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.
  - K. Restore: To consolidate, replicate, reproduce, repair, and refinish as required to achieve the indicated results.
  - L. Retain: To keep existing items that are not to be removed or dismantled.
  - M. Reversible: New construction work, treatments, or processes that can be removed or undone in the future without damaging historic materials unless otherwise indicated.
  - N. Salvage: To protect removed or dismantled items and prepare for reinstallation at locations indicated on the Drawings.
  - O. Stabilize: To provide structural reinforcement of unsafe or deteriorated items while maintaining the essential form as it exists at present; also, to reestablish a weather-resistant enclosure.
  - P. Strip: To remove existing finish down to base material unless otherwise indicated.
- 1.4 INFORMATIONAL SUBMITTALS
- A. Preconstruction Documentation: Show preexisting conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by Contractor's historic treatment operations.
  - B. Inventory of Salvaged Items: After removal or dismantling work is complete, submit a list of items that have been salvaged.

## 1.5 QUALITY ASSURANCE

- A. Historic Treatment Specialist Qualifications: An experienced firm regularly engaged in historic treatments similar in nature, materials, design, and extent to this work as specified in each section, and that has completed a minimum of five recent projects with a record of successful in-service performance that demonstrate the firm's qualifications to perform this work.
  - 1. Field Supervisor Qualifications: Full-time supervisors experienced in historic treatment work similar in nature, material, design, and extent to that indicated for this Project. Supervisors shall be on Project site during times that historic treatment work is in progress. Supervisors shall not be changed during Project except for causes beyond the control of the specialist firm.
- B. Historic Removal and Dismantling Specialist Qualifications: A qualified historic treatment specialist. General selective demolition experience is not sufficient experience for historic removal and dismantling work.
- C. Historic Treatment Program: Prepare a written plan for historic treatment for whole Project, including each phase or process and protection of surrounding materials during operations. Describe in detail materials, methods, and equipment to be used for each phase of work. Show compliance with indicated methods and procedures specified in this and other Sections.
- D. Mockups: Prepare mockups of specific historic treatment procedures specified in this Section to demonstrate aesthetic effects and to set quality standards for materials and execution.
  - 1. Typical Removal Work: Remove typical Insert description as shown on Drawings.
  - 2. Typical Dismantling Work: Dismantle typical historic light fixture as shown on Drawings.
  - 3. Typical Removal Work: Remove an area of typical wall suspended ceiling assembly, but not less than 10 adjacent whole ceiling tile units.
  - 4. Typical Dismantling Work: Dismantle an approximately 50-sq. ft. area of typical Insert description, but not less than 10 adjacent whole composition tile units.
  - 5. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
- E. Regulatory Requirements: Comply with notification regulations of authorities having jurisdiction before beginning removal and dismantling work. Comply with hauling and disposal regulations of authorities having jurisdiction.
- F. Standards: Comply with ANSI/ASSE A10.6.
- G. Historic Treatment Preconstruction Conference: Conduct conference at Project site.
  - 1. General: Review methods and procedures related to historic treatment including, but not limited to, the following:
    - a. Review manufacturer's written instructions for precautions and effects of historic treatment procedures on materials, components, and vegetation.

- b. Review and finalize historic treatment construction schedule; verify availability of materials, equipment, and facilities needed to make progress and avoid delays.
  - c. Review qualifications of personnel assigned to the work and assign duties.
  - d. Review material application, work sequencing, tolerances, and required clearances.
  - e. Review areas where existing construction is to remain and requires protection.
2. Removal and Dismantling:
- a. Inspect and discuss condition of construction to be removed or dismantled.
  - b. Review requirements of other work that relies on substrates exposed by removal and dismantling work.

## 1.6 STORAGE AND PROTECTION OF HISTORIC MATERIALS

### A. Salvaged Historic Materials:

- 1. Clean only loose debris from salvaged historic items unless more extensive cleaning is indicated.
- 2. Pack or crate items after cleaning; cushion against damage during handling. Label 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.

### B. Historic Materials for Reinstallation:

- 1. Repair and clean historic items as indicated and to functional condition for reuse.
- 2. Pack or crate items after cleaning and repairing; cushion against damage during handling. Label 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 unless otherwise indicated. Provide connections, supports, and miscellaneous materials to make item functional for use indicated.

### C. Existing Historic Materials to Remain: Protect construction indicated to remain against damage and soiling from construction work. Where permitted by Architect, items may be dismantled and taken to a suitable, protected storage location during construction work and reinstalled in their original locations after historic treatment and construction work in the vicinity is complete.

### D. Storage and Protection: When taken from their existing locations, catalog and store historic items within a weathertight enclosure where they are protected from wetting by rain, snow, condensation, or ground water, and from freezing temperatures.

- 1. Identify each item with a nonpermanent mark to document its original location. Indicate original locations on plans elevations, sections, or photographs by annotating the identifying marks.
- 2. Secure stored materials to protect from theft.

1.7 PROJECT CONDITIONS

- A. General Size Limitation in Historic Spaces: Materials, products, and equipment used for performing the Work and for transporting debris, materials, and products shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, including temporary protection, by 12 inches or more.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with removal and dismantling work.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
  - 1. Hazardous materials have been removed by Owner before start of the Work.
  - 2. If additional materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Owner will remove hazardous materials under a separate contract.
    - a. In the case of asbestos, stop work in the area of potential hazard, shut off fans and other airhandlers ventilating the area, and rope off area until the questionable material is identified. Re-assign workers to continue work in unaffected areas. Resume work in the area of concern after safe working conditions are verified.
- E. Storage or sale of removed or dismantled items on-site is not permitted unless otherwise indicated.

1.8 COORDINATION

- A. Coordinate historic treatment procedures in this Section with public circulation patterns at Project site. Some work is near public circulation patterns and active alley. Public circulation patterns cannot be closed off entirely, and in places can be only temporarily redirected around small areas of work. Plan and execute the Work accordingly.

PART 2 - PRODUCTS - (Not Used)

## PART 3 - EXECUTION

### 3.1 HISTORIC REMOVAL AND DISMANTLING EQUIPMENT

- A. Removal Equipment: Use only hand-held tools except as follows or unless otherwise approved by Architect on a case-by-case basis:
  - 1. Light jackhammers are allowed subject to Architect's approval.
  - 2. Large air hammers are not permitted.
- B. Dismantling Equipment: Use manual, hand-held tools, except as follows or otherwise approved by Architect on a case-by-case basis:
  - 1. Hand-held power tools and cutting torches are permitted only as submitted in the historic treatment program. They must be adjustable so as to penetrate or cut only the thickness of material being removed.
  - 2. Pry bars more than 18 inches long and hammers weighing more than 2 lb are not permitted for dismantling work.

### 3.2 EXAMINATION

- A. Preparation for Removal and Dismantling: Examine construction to be removed or dismantled to determine best methods to safely and effectively perform removal and dismantling work. Examine adjacent work to determine what protective measures will be necessary. Make explorations, probes, and inquiries as necessary to determine condition of construction to be removed or dismantled and location of utilities and services to remain that may be hidden by construction that is to be removed or dismantled.
  - 1. Verify that affected utilities have been disconnected and capped.
  - 2. Inventory and record the condition of items to be removed and dismantled for reinstallation or salvage.
  - 3. Before removal or dismantling of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.
  - 4. Engage a professional engineer to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures as a result of removal and dismantling work.
- B. Perform surveys as the Work progresses to detect hazards resulting from historic treatment procedures.



### 3.3 PROTECTION, GENERAL

- A. Comply with temporary barrier requirements in Section 01 5000 "Temporary Facilities and Controls."
- B. Ensure that supervisory personnel are on-site and on duty when historic treatment work begins and during its progress.
- C. Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from historic treatment procedures.
  - 1. Use only proven protection methods, appropriate to each area and surface being protected.
  - 2. Provide barricades, barriers, and temporary directional signage to exclude public from areas where historic treatment work is being performed.
  - 3. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during course of historic treatment work.
  - 4. Contain dust and debris generated by removal and dismantling work and prevent it from reaching the public or adjacent surfaces.
  - 5. Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
  - 6. Protect floors and other surfaces along haul routes from damage, wear, and staining.
  - 7. Provide supplemental sound-control treatment to isolate removal and dismantling work from other areas of the building.
- D. Temporary Protection of Historic Materials:
  - 1. Protect existing historic materials with temporary protections and construction. Do not deface or remove existing materials.
  - 2. Do not attach temporary protection to historic surfaces except as indicated as part of the historic treatment program and approved by Architect.
- E. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.
- F. Utility and Communications Services:
  - 1. Notify Owner, Architect, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by the historic treatment work before commencing operations.
  - 2. Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for the historic treatment work.

- G. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is in working order.
  - 1. Prevent solids such as stone or mortar residue from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from historic treatment work.
  - 2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.
- H. Existing Roofing: Is to be replaced.

### 3.4 PROTECTION DURING APPLICATION OF CHEMICALS

- A. Protect motor vehicles, surrounding surfaces of building being restored, building site, plants, and surrounding buildings from harm or damage resulting from applications of chemical cleaners and paint removers.
- B. Cover adjacent surfaces with protective materials that are proven to resist chemicals selected for Project unless chemicals being used will not damage adjacent surfaces as indicated in historic treatment program. Use covering materials and masking agents that are waterproof, UV resistant, and will not stain or leave residue on surfaces to which they are applied. Apply protective materials according to manufacturer's written instructions. Do not apply liquid masking agents or adhesives to painted or porous surfaces. When no longer needed, promptly remove protective materials staining.
- C. Do not apply chemicals during winds of sufficient force to spread them to unprotected surfaces.
- D. Neutralize and collect alkaline and acid wastes and legally dispose of off Owner's property.
- E. Collect and dispose of runoff from chemical operations by legal means and in a manner that prevents soil contamination, soil erosion, undermining of paving and foundations, damage to landscaping, or water penetration into building interior.

### 3.5 PROTECTION FROM FIRE

- A. General: Follow fire-prevention plan and the following.
  - 1. Comply with NFPA 241 requirements unless otherwise indicated. Perform duties entitled "Owner's Responsibility for Fire Protection."
  - 2. Remove and keep area free of combustibles including, rubbish, paper, waste, and chemicals, except to the degree necessary for the immediate work.
    - a. If combustible material cannot be removed, provide fire blankets to cover such materials.

3. Prohibit smoking by all persons within Project work and staging areas.
- B. Heat-Generating Equipment and Combustible Materials: Comply with the following procedures while performing work with heat-generating equipment or highly combustible materials, including welding, torch-cutting, soldering, brazing, paint removal with heat, or other operations where open flames or implements utilizing high heat or combustible solvents and chemicals are anticipated:
1. As far as practical, restrict heat-generating equipment to shop areas or outside the building.
  2. Fire Watch: Before working with heat-generating equipment or highly combustible materials, station personnel to serve as a fire watch at each location where such work is performed. Fire-watch personnel shall have the authority to enforce fire safety. Station fire watch according to NFPA 51B, NFPA 241, and as follows.
    - a. Train each fire watch in the proper operation of fire-control equipment and alarms.
    - b. Prohibit fire-watch personnel from other work that would be a distraction from fire-watch duties.
    - c. Cease work with heat-generating equipment whenever fire-watch personnel are not present.
    - d. Maintain fire-watch personnel at[ each area of] Project site until 60 minutes after conclusion of daily work.
- C. Fire Extinguishers, Fire Blankets, and Rag Buckets: Maintain fire extinguishers, fire blankets, and rag buckets for disposal of rags with combustible liquids. Maintain each as suitable for the type of fire risk in each work area. Ensure that nearby personnel and the fire watch are trained in fire-extinguisher and blanket operation.
- 3.6 GENERAL HISTORIC TREATMENT
- A. Ensure that supervisory personnel are present when historic treatment work begins and during its progress.
- B. Halt the process of deterioration and stabilize conditions unless otherwise indicated. Perform work as indicated on Drawings. Follow the procedures in subparagraphs below and procedures approved in historic treatment program:
1. Retain as much existing material as possible; repair and consolidate rather than replace.
  2. Use additional material or structure to reinforce, strengthen, prop, tie, and support existing material or structure.
  3. Use reversible processes wherever possible.
  4. Use historically accurate repair and replacement materials and techniques unless otherwise indicated.
  5. Record existing work before each procedure (preconstruction) and progress during the work with digital preconstruction documentation photographs or video recordings. Comply with requirements in Section 01 3233 "Photographic Documentation."

- C. Notify Architect of visible changes in the integrity of material or components whether due to environmental causes including biological attack, UV degradation, freezing, or thawing; or due to structural defects including cracks, movement, or distortion.
  - 1. Do not proceed with the work in question until directed by Architect.
- D. Where missing features are indicated to be repaired or replaced, provide features whose designs are based on accurate duplications rather than on conjectural designs, subject to approval of Architect.
- E. Where Work requires existing features to be removed or dismantled and reinstalled, perform these operations without damage to the material itself, to adjacent materials, or to the substrate.
- F. Identify new and replacement materials and features with permanent marks hidden in the completed work to distinguish them from original materials. Record a legend of identification marks and the locations of the items on record Drawings.

### 3.7 HISTORIC REMOVAL AND DISMANTLING

- A. General: Have removal and dismantling work performed by a qualified historic removal and dismantling specialist. Ensure that historic removal and dismantling specialist's field supervisors are present when removal and dismantling work begins and during its progress.
- B. Perform work according to the historic treatment program.
  - 1. Provide supports or reinforcement for existing construction that becomes temporarily weakened by the work, until the work is completed.
  - 2. Perform cutting by hand or with small power tools wherever possible. Cut holes and slots neatly to size required, with minimum disturbance of adjacent work.
  - 3. Do not operate air compressors inside building, unless approved by Architect in each case.
  - 4. Do not drill or cut columns, beams, joints, girders, structural slabs, or other structural supporting elements, without having Contractor's professional engineer's written approval for each location before such work is begun.
  - 5. Do not use explosives.
- C. Water-Mist Sprinkling: Use water-mist sprinkling and other wet methods to control dust only with adequate, approved procedures and equipment that ensure that such water will not create a hazard or adversely affect other building areas or materials.
- D. Unacceptable Equipment: Keep equipment that is not permitted for historic removal or dismantling work away from the vicinity where such work is being performed.
- E. Removing and Dismantling Items on or near Historic Surfaces:
  - 1. Use only dismantling tools and procedures within 12 inches of historic surface. Do not use pry bars. Protect historic surface from contact with or damage by tools.

2. Unfasten items to be removed, in the opposite order from which they were installed.
3. Support each item as it becomes loosened to prevent stress and damage to the historic surface.
4. Dismantle anchorages.

F. Masonry Walls:

1. Remove masonry carefully and erect temporary bracing and supports as needed to prevent collapse of materials being removed.
2. Dismantle top edge and sides before removing wall. Stop removal work and immediately inform Architect if any structural elements above or adjacent to the work show signs of distress or dislocation during any phase of removal work.
3. Remove wall in easily managed pieces.
4. During removal, Contractor is responsible for the stability of the partially remaining wall. Notify Architect of the condition of temporary bracing for wall if work is temporarily stopped during the wall's removal.

G. Steelwork:

1. Expose structural steel for examination by Architect and Contractor's professional engineer before proceeding with removal or dismantling.
2. If distress in structure is apparent during performance of the work, stop removal or dismantling and take immediate precautionary measures to ensure safety of the structure. Inform Architect of the problem, steps taken, and proposed corrective actions.
3. Brace and support structural steel being removed and remaining during removal and dismantling.

H. Loose Plaster: Identify loose, non-historic plaster and separate it from its substrate by tapping with a hammer and prying with a chisel or screwdriver. Do not use pry bars. Leave sound, firmly adhered plaster in place. Do not damage, remove, or dismantle historic plasterwork except where indicated or where it is an immediate hazard to personnel and as approved by Architect.

I. Concrete Floor Surface Removal: Remove floor surfaces, fill, and topping, to the indicated lower elevations or cleavage planes as indicated on Drawings. Use dismantling methods when removing floor surfaces 12 inches or less away from historic walls. Take away material to a uniform surface at the indicated level.

J. Anchorages:

1. Remove anchorages associated with removed items.
2. Dismantle anchorages associated with dismantled items.
3. In non-historic surfaces, patch holes created by anchorage removal or dismantling according to the requirements for new work.
4. In historic surfaces, patch or repair holes created by anchorage removal or dismantling according to Section specific to the historic surface being patched.

END OF SECTION 01 3591

## SECTION 01 4000 - QUALITY REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.

#### 1.3 DEFINITIONS

- A. Mockups: Full-size physical assemblies that are constructed on-site either as freestanding temporary built elements or as part of permanent construction. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
- B. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- C. 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.

#### 1.4 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. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

- 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, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
  - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
  - 1. Build mockups of size indicated.
  - 2. Build mockups in location indicated or, if not indicated, as directed by Architect.
  - 3. Notify Architect days in advance of dates and times when mockups will be constructed.
  - 4. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed to perform same tasks during the construction at Project.
  - 5. Demonstrate the proposed range of aesthetic effects and workmanship.

6. Obtain Architect's approval of mockups before starting corresponding work, fabrication, or construction.
  - a. Allow seven days for initial review and each re-review of each mockup.
7. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
8. Demolish and remove mockups when directed unless otherwise indicated.

#### 1.5 QUALITY CONTROL

- A. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
- B. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
- 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 01 3300 "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. Associated Contractor Services: Cooperate with agencies and representatives 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 inspection. 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 inspection equipment at Project site.
- F. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.



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 reference during normal working hours.
  - 1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspection, 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 01 7300 "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 01 4000

## SECTION 01 5000 - TEMPORARY FACILITIES AND CONTROLS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
  - 1. Section 01 1000 "Summary" for work restrictions and limitations on utility interruptions.

#### 1.3 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Architect, testing agencies, and authorities having jurisdiction.
- B. Sewer Service: Pay sewer-service use charges for sewer usage by all entities for construction operations.
- C. Water Service: Pay water-service use charges for water used by all entities for construction operations.
- D. Electric Power Service: Pay electric-power-service use charges for electricity used by all entities for construction operations.

#### 1.4 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Accessible Temporary Egress: Comply with applicable provisions in the United States Access Board's ADA-ABA Accessibility Guidelines.

## 1.5 PROJECT CONDITIONS

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

## PART 2 - PRODUCTS

### 2.1 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
  - 1. Store combustible materials apart from building.

### 2.2 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
  - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
  - 2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

## PART 3 - EXECUTION

### 3.1 TEMPORARY FACILITIES, GENERAL

- A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
  - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

### 3.2 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
  - 1. Locate facilities to limit site disturbance as specified in Section 01 1000 "Summary."
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

### 3.3 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
  - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- E. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
  - 1. Provide temporary dehumidification systems when required to reduce ambient and substrate moisture levels to level required to allow installation or application of finishes and their proper curing or drying.
- F. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
- G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
- H. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel.
  - 1. At each telephone, post a list of important telephone numbers.

### 3.4 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.

1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

D. Parking: Provide temporary parking areas for construction personnel.

E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as indicated on Drawings.
2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
  - a. Provide temporary, directional signs for construction personnel and visitors.
3. Maintain and touch up signs so they are legible at all times.

G. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 01 7300 "Execution."

- H. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
  - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- I. Temporary Elevator Use: Use of elevators is not permitted.
- J. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.
- K. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

### 3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- C. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- D. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- E. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using materials approved by authorities having jurisdiction.
- F. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- G. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

- H. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
  - 1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
- I. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
  - 1. Prohibit smoking in construction areas. Comply with additional limits on smoking specified in other Sections.
  - 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.

### 3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

END OF SECTION 01 5000

## SECTION 01 7300 - EXECUTION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
  - 1. Construction layout.
  - 2. Field engineering and surveying.
  - 3. Installation of the Work.
  - 4. Cutting and patching.
  - 5. Coordination of Owner-installed products.
  - 6. Progress cleaning.
  - 7. Starting and adjusting.
  - 8. Protection of installed construction.
- B. Related Requirements:
  - 1. Section 01 1000 "Summary" for limits on use of Project site.
  - 2. Section 01 3300 "Submittal Procedures" for submitting surveys.
  - 3. Section 01 7700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
  - 4. Section 02 4119 "Selective Demolition" for demolition and removal of selected portions of the building.
  - 5. Section 07 8413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

#### 1.3 DEFINITIONS

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



#### 1.4 PREINSTALLATION MEETINGS

- A. Cutting and Patching Conference: Conduct conference at Project site.
  - 1. Prior to commencing work requiring cutting and patching, review extent of cutting and patching anticipated and examine procedures for ensuring satisfactory result from cutting and patching work. Require representatives of each entity directly concerned with cutting and patching to attend, including the following:
    - a. Contractor's superintendent.
    - b. Trade supervisor responsible for cutting operations.
    - c. Trade supervisor(s) responsible for patching of each type of substrate.
    - d. Mechanical, electrical, and utilities subcontractors' supervisors, to the extent each trade is affecting by cutting and patching operations.
  - 2. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer.
- B. Certificates: Submit certificate signed by professional engineer certifying that location and elevation of improvements comply with requirements.
- C. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Architect's approval to proceed is required. Include the following information:
  - 1. Extent: Describe reason for and extent of each occurrence of cutting and patching, including how work will be performed and why the work cannot be avoided.
  - 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
  - 3. Products: List products to be used for patching and firms or entities that will perform patching work.
  - 4. Dates: Indicate when cutting and patching will be performed.
  - 5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
    - a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

#### 1.6 QUALITY ASSURANCE

- A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.
- B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
  1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
  2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:
    - a. Primary operational systems and equipment.
    - b. Fire separation assemblies.
    - c. Air or smoke barriers.
    - d. Fire-suppression systems.
    - e. Plumbing piping systems.
    - f. Mechanical systems piping and ducts.
    - g. Control systems.
    - h. Communication systems.
    - i. Fire-detection and -alarm systems.
    - j. Conveying systems.
    - k. Electrical wiring systems.
    - l. Operating systems of special construction.
  3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
    - a. Water, moisture, or vapor barriers.
    - b. Membranes and flashings.
    - c. Exterior curtain-wall construction.
    - d. Sprayed fire-resistive material.
    - e. Equipment supports.

- f. Piping, ductwork, vessels, and equipment.
  - g. Noise- and vibration-control elements and systems.
- 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- 5. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.
- C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

## 1.7 WARRANTY

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

## PART 2 - PRODUCTS

### 2.1 MATERIALS

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

## PART 3 - EXECUTION

### 3.1 EXAMINATION

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

### 3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 01 3100 "Project Management and Coordination."
- E. Cutting and Patching.
  - 1. Temporary Support: Provide temporary support of Work to be cut.
  - 2. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
  - 3. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
  - 4. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas. Contractor shall notify the Owner, in writing, 48-hours in advance of an interruption of utilities.

### 3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect[ and Construction Manager] promptly.
- B. General: Engage a [land surveyor] [professional engineer] to lay out the Work using accepted surveying practices.
  - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
  - 2. Establish limits on use of Project site.
  - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
  - 4. Inform installers of lines and levels to which they must comply.
  - 5. Check the location, level and plumb, of every major element as the Work progresses.
  - 6. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
  - 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

### 3.4 FIELD ENGINEERING

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

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

### 3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  - 1. Make vertical work plumb and make horizontal work level.
  - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
  - 4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Where possible, select tools or equipment that minimize production of excessive noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
  - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
  - 2. Allow for building movement, including thermal expansion and contraction.
  - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Repair or remove and replace damaged, defective, or nonconforming Work.
  - 1. Comply with Section 01 7700 "Closeout Procedures" for repairing or removing and replacing defective Work.

### 3.6 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
  - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 01 1000 "Summary."
- F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.



- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
  3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
  5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
  6. Proceed with patching after construction operations requiring cutting are complete.
- H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
  2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
    - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    - b. Restore damaged pipe covering to its original condition.
  3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
  4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.

5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

### 3.7 OWNER-INSTALLED PRODUCTS

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

### 3.8 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
  1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
  3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
    - a. Use containers intended for holding waste materials of type to be stored.
  4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
  1. Remove liquid spills promptly.
  2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01 5000 "Temporary Facilities and Controls."
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### 3.9 STARTING AND ADJUSTING

- A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 01 9113 "General Commissioning Requirements."
- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Manufacturer's Field Service: Comply with qualification requirements in Section 01 4000 "Quality Requirements."

### 3.10 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

- B. Protection of Existing Items: Provide protection and ensure that existing items to remain undisturbed by construction are maintained in condition that existed at commencement of the Work.
- C. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 01 7300

## SECTION 01 7700 - CLOSEOUT PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
  - 1. Substantial Completion procedures.
  - 2. Final completion procedures.
  - 3. Warranties.
  - 4. Final cleaning.
  - 5. Repair of the Work.
- B. Related Requirements:
  - 1. Section 01 7823 "Operation and Maintenance Data" for additional operation and maintenance manual requirements.
  - 2. Section 01 7900 "Demonstration and Training" for requirements to train the Owner's maintenance personnel to adjust, operate, and maintain products, equipment, and systems.

#### 1.3 ACTION SUBMITTALS

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

#### 1.4 CLOSEOUT SUBMITTALS

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

## 1.5 MAINTENANCE MATERIAL SUBMITTALS

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

## 1.6 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
  - 1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, 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.
    - 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 testing, adjusting, and balancing records.
  - 6. Submit sustainable design submittals not previously submitted.
  - 7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
  - 1. Advise Owner of pending insurance changeover requirements.
  - 2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
  - 3. Complete startup and testing of systems and equipment.
  - 4. Perform preventive maintenance on equipment used prior to Substantial Completion.

5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 7900 "Demonstration and Training."
6. Advise Owner of changeover in utility services.
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.
10. Touch up paint and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. 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.

#### 1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Section 01 2900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.
5. Submit final completion photographic documentation.

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. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

## 1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
  - 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. MS Excel electronic file. Architect will return annotated file.
    - b. PDF electronic file. Architect will return annotated file.
    - c. Web-based project software upload. Utilize software feature for creating and updating list of incomplete items (punch list).

## 1.9 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 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.
- D. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
  - 1. Submit by uploading to web-based project software site.
- E. Provide additional copies of each warranty to include in operation and maintenance manuals.



## PART 2 - PRODUCTS

### 2.1 MATERIALS

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

## PART 3 - EXECUTION

### 3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
  - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
    - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    - c. Rake grounds that are not planted, mulched, or paved to a smooth, even-textured surface.
    - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    - e. Remove snow and ice to provide safe access to building.
    - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    - h. Sweep concrete floors broom clean in unoccupied spaces.

- i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
  - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
  - k. Remove labels that are not permanent.
  - l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
  - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
  - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
  - o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
  - p. Clean luminaires, lamps, globes, and reflectors to function with full efficiency.
  - q. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 01 5000 "Temporary Facilities and Controls." Prepare written report.

### 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 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 01 7700

## SECTION 01 7823 - OPERATION AND MAINTENANCE DATA

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Operation and maintenance documentation directory manuals.
  - 2. Emergency manuals.
  - 3. Systems and equipment operation manuals.
  - 4. Systems and equipment maintenance manuals.
  - 5. Product maintenance manuals.
- B. Related Requirements:
  - 1. Section 01 1200 "Multiple Contract Summary" for coordinating operation and maintenance manuals covering the Work of multiple contracts.
  - 2. Section 01 3300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.

#### 1.3 DEFINITIONS

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

#### 1.4 CLOSEOUT SUBMITTALS

- A. Submit operation and maintenance manuals indicated. Provide content for each manual as specified in individual Specification Sections, and as reviewed and approved at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
  - 1. Architect will comment on whether content of operation and maintenance submittals is acceptable.
  - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

- B. Format: Submit operation and maintenance manuals in the following format:
  - 1. Submit by uploading to web-based project software site. Enable reviewer comments on draft submittals.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return copy with comments.
  - 1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.
- E. Comply with Section 01 7700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

#### 1.5 FORMAT OF OPERATION AND MAINTENANCE MANUALS

- A. 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: Bookmark 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.
- B. Manuals, Paper Copy: Submit manuals in the form of hard-copy, bound and labeled volumes.

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

- A. Organization of Manuals: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
  - 1. Title page.
  - 2. Table of contents.
  - 3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Authority.
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.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. 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."

1.7 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY MANUAL

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals. List items and their location to facilitate ready access to desired information. Include the following:

1. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
2. 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.
3. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

## 1.8 EMERGENCY MANUALS

- A. 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.
- B. Content: Organize manual into a separate section for each of the following:
  - 1. Type of emergency.
  - 2. Emergency instructions.
  - 3. Emergency procedures.
- C. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
  - 1. Fire.
  - 2. Flood.
  - 3. Gas leak.
  - 4. Water leak.
  - 5. Power failure.
  - 6. Water outage.
  - 7. System, subsystem, or equipment failure.
  - 8. Chemical release or spill.
- D. 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.
- E. 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.

## 1.9 SYSTEMS AND EQUIPMENT OPERATION MANUALS

- A. Systems and Equipment Operation Manual: Assemble a complete set of data indicating operation of each system, subsystem, and piece of equipment not part of a system. Include information required for daily operation and management, operating standards, and routine and special operating procedures.
  - 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.

- B. 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.
- C. 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.
- D. 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.
- E. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- F. Piped Systems: Diagram piping as installed, and identify color coding where required for identification.



1.10 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Systems and Equipment Maintenance Manuals: Assemble a complete set of data indicating maintenance of each system, subsystem, and piece of equipment not part of a system. Include manufacturers' maintenance documentation, preventive maintenance procedures and frequency, repair procedures, wiring and systems diagrams, lists of spare parts, and warranty information.
  - 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.
- B. 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 warranties and bonds as described below.
- C. 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.
- D. Manufacturers' Maintenance Documentation: Include the following information for each component part or piece of equipment:
  - 1. Standard maintenance instructions and bulletins; 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.
    - a. 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.
  - 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.
- E. 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.
- F. 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.
- G. 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.
- H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- I. 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.
- J. 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 maintenance manuals.
- 1.11 PRODUCT MAINTENANCE MANUALS
- A. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- B. 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.
- C. 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.

- D. 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.
- E. 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.
- F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- G. 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 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 7823

## SECTION 01 7900 - DEMONSTRATION AND TRAINING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

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

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Attendance Record: For each training module, submit list of participants and length of instruction time.

#### 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. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 4000 "Quality Requirements," experienced in operation and maintenance procedures and training.

#### 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 have been reviewed and approved by Architect.

#### 1.6 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. 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.
  - 3. Troubleshooting: Include the following:
    - a. Diagnostic instructions.
    - b. Test and inspection procedures.
  - 4. 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.

#### 1.7 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 01 7823 "Operation and Maintenance Data."
- B. Set up instructional equipment at instruction location.

#### 1.8 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. Architect will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
  - 2. Owner will furnish an instructor to describe Owner's operational philosophy.
  - 3. Owner will furnish Contractor with names and positions of participants.
- C. Scheduling: Provide instruction at mutually agreed-on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
  - 1. Schedule training with Owner, through Architect, with at least seven days' advance notice.
- 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.

#### PART 2 - PRODUCTS

#### PART 3 - EXECUTION

END OF SECTION 01 7900

## SECTION 02 41 16 - STRUCTURE DEMOLITION

### 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. Demolition and removal of buildings and site improvements.
  - 2. Removing below-grade construction.
  - 3. Disconnecting, capping or sealing, and removing site utilities.
  - 4. Salvaging items for reuse by Owner.
- B. Related Sections:
  - 1. Section 02 41 19 "Selective Demolition" for partial demolition of buildings, structures, and site improvements.

#### 1.3 DEFINITIONS

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

#### 1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- 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.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit informational report, including Drawings, that indicates 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.
  - 1. Adjacent Buildings: Detail special measures proposed to protect adjacent buildings to remain.
- B. Schedule of Building Demolition Activities: Indicate the following:
  - 1. Detailed sequence of demolition work, with starting and ending dates for each activity.
  - 2. Temporary interruption of utility services.
  - 3. Shutoff and capping of utility services.
- C. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.
- D. Predemolition Photographs or Video: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by demolition operations. Submit before the Work begins.
- E. 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.

## 1.6 QUALITY ASSURANCE

- A. Predemolition Conference: Conduct conference at Project site.
  - 1. Inspect and discuss condition of construction to be demolished.
  - 2. Review structural load limitations of existing structures.
  - 3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
  - 4. Review and finalize protection requirements.
  - 5. Review procedures for noise control and dust control.
  - 6. Review procedures for protection of adjacent buildings.
  - 7. Review items to be salvaged and returned to Owner.

## 1.7 PROJECT CONDITIONS

- A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.



- B. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.
  - 1. Provide not less than 72 hours' notice of activities that will affect operations of adjacent occupied buildings.
  - 2. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.
    - a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.
- C. Owner assumes no responsibility for buildings and structures to be demolished.
- D. Hazardous Materials: Hazardous materials are present in buildings and structures to be demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

#### 1.8 COORDINATION

- A. Arrange demolition schedule so as not to interfere with operations of adjacent occupied buildings.

### PART 2 - PRODUCTS (Not Used)

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting demolition operations.
- B. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.

#### 3.2 PREPARATION

- A. Refrigerant: Remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction before starting demolition.
- B. Existing Utilities: Locate, identify, disconnect, and seal or cap off indicated utilities serving buildings and structures to be demolished.
  - 1. Arrange to shut off indicated utilities with utility companies.

2. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
  3. Cut off pipe or conduit a minimum of 24 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.
- C. Existing Utilities: See plumbing and electrical Sections for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.
- D. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.
1. Strengthen or add new supports when required during progress of demolition.
- E. Salvaged Items: Comply with the following:
1. Clean salvaged items of dirt and demolition debris.
  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 storage area designated by Owner.
  5. Protect items from damage during transport and storage.

### 3.3 PROTECTION

- A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.
- B. Existing Utilities: Maintain utility services to remain and protect from damage during demolition operations.
1. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.
    - a. Provide at least 72 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.

- C. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Section 01 5000 "Temporary Facilities and Controls."
1. Protect adjacent buildings and facilities from damage due to demolition activities.
  2. Protect existing site improvements, appurtenances, and landscaping to remain.
  3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
  4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  5. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
  6. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
  7. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.
- D. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

### 3.4 DEMOLITION, GENERAL

- A. General: Demolish indicated buildings[ and site improvements] completely. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
  2. Maintain fire watch during and for at least <Insert number> hours after flame cutting operations.
  3. Maintain adequate ventilation when using cutting torches.
  4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
- B. Engineering Surveys: During demolition, perform surveys to detect hazards that may result from building demolition activities.
- C. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

### 3.5 DEMOLITION BY MECHANICAL MEANS

- A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.
- B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
  1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.
- C. Salvage: Items to be removed and salvaged are indicated [on Drawings.] [below:]
- D. Below-Grade Construction: Demolish foundation walls and other below-grade construction.
  1. Remove below-grade construction, including basements, foundation walls, and footings, completely.
- E. Existing Utilities: Abandon existing utilities and below-grade utility structures. Cut utilities flush with grade.

### 3.6 CLEANING

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

END OF SECTION 02 41 16

## SECTION 02 41 19 - SELECTIVE DEMOLITION

### 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. Demolition and removal of selected site elements.
- B. Related Requirements:
  - 1. Section 01 1000 "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
  - 2. Section 01 3591 "Historic Treatment Procedures" for historic removal and dismantling.

#### 1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Carefully detach 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, prepare for reuse, and reinstall where indicated.
- D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

#### 1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- 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.

1.5 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 requires protection.

1.6 INFORMATIONAL SUBMITTALS

- A. Schedule of Selective Demolition Activities: Indicate the following:
1. Coordination for shutoff, capping, and continuation of utility services.
  2. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- B. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.
- C. Predemolition Photographs or Video: Submit before Work begins.
- D. 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.

1.7 FIELD CONDITIONS

- A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
1. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
- C. Historic Areas: Demolition and hauling equipment and other materials shall be of sizes that clear surfaces within historic spaces, areas, rooms, and openings, including temporary protection, by 12 inches (300 mm) or more.
- D. Storage or sale of removed items or materials on-site is not permitted.

- E. 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.

## 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 ANSI/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 record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.
- C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- D. 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.
- E. Survey of Existing Conditions: Record existing conditions by use of measured drawings.
  - 1. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

### 3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Comply with requirements for existing services/systems interruptions specified in Section 01 1000 "Summary."

- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
  - 1. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.
    - a. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    - b. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.

### 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 01 5000 "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.
- C. 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.

### 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, to minimize disturbance of adjacent surfaces. 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 fire watch and 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. Dispose of demolished items and materials promptly.
- B. Work in Historic Areas: Selective demolition may be performed only in areas of the Project that are not designated as historic. In historic spaces, areas, and rooms or on historic surfaces, the terms "demolish" or "remove" shall mean historic "removal" or "dismantling" as specified in Section 01 3591 "Historic Treatment Procedures."
- C. Removed and Salvaged Items:
1. Pack or crate items after cleaning. Identify contents of containers.
  2. Transport items to Owner's storage area designated by Owner.
  3. 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, then remove concrete between saw cuts.

- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.
- C. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight. See Section 07 5323 EPDM for new roofing requirements.
  - 1. Remove existing roof membrane, flashings, copings, and roof accessories.
  - 2. Remove existing roofing system down to substrate.

### 3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be[ recycled,] reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site[ and legally dispose of them in an EPA-approved landfill].
  - 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.
- 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 02 4119

## SECTION 03 3000 - CAST-IN-PLACE CONCRETE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. The Drawings and the general provisions of the Contract, Standard General Conditions, Supplementary Conditions, and other Division 01 Specification Sections, apply to each section of this Project's specifications.

#### 1.2 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
  - 1. Footings.
  - 2. Foundation walls.
  - 3. Slabs-on-grade.
  - 4. Building walls.

#### 1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: fly ash and other pozzolans, subject to compliance with requirements.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
  - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Samples: For waterstops and vapor retarder.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each of the following, signed by manufacturers:
  - 1. Cementitious materials.
  - 2. Admixtures.
  - 3. Form materials and form-release agents.
  - 4. Steel reinforcement and accessories.
  - 5. Waterstops.
  - 6. Curing compounds.
  - 7. Floor and slab treatments.
  - 8. Bonding agents.
  - 9. Adhesives.
  - 10. Vapor retarders.
  - 11. Semirigid joint filler.
  - 12. Joint-filler strips.
  - 13. Repair materials.
- B. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
- C. Field quality-control reports.

## 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
  - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
- C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- D. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
  - 1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
  - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- E. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

## PART 2 - PRODUCTS

### 2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints. Use for concrete exposed to view.
  - 1. Plywood, metal, or other approved panel materials.
  - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
    - a. High-density overlay, Class 1 or better.
    - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
    - c. Structural 1, B-B or better; mill oiled and edge sealed.
    - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- D. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- E. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- F. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
  - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- G. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
  - 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.

2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

## 2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- C. Epoxy-Coated Reinforcing Bars: ASTM A 615/A 615M, Grade 60 ASTM A 706/A 706M, deformed bars, ASTM A 775/A 775M or ASTM A 934/A 934M, epoxy coated, with less than 2 percent damaged coating in each 12-inch bar length.
- D. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.
- E. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

## 2.3 REINFORCEMENT ACCESSORIES

- A. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
  1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
  2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

## 2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
  1. Portland Cement: ASTM C 150, Type I, Type II, Type III, Type V, gray. Supplement with the following:
    - a. Fly Ash: ASTM C 618, Class F.

- B. Normal-Weight Aggregates: ASTM C 33, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source.
  - 1. Maximum Coarse-Aggregate Size: 1 inch nominal.
  - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94/C 94M and potable.

## 2.5 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
  - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
  - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
  - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
  - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
  - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
  - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Axim Italcementi Group, Inc.; CATEXOL CN-CI.
    - b. BASF Construction Chemicals - Building Systems; Rheocrete CNI.
    - c. Euclid Chemical Company (The), an RPM company.
    - d. Grace Construction Products, W. R. Grace & Co.; DCI.
    - e. Sika Corporation; Sika CNI.
- D. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. BASF Construction Chemicals - Building Systems; Rheocrete 222+.
    - b. Cortec Corporation; MCI- 2005NS.
    - c. Grace Construction Products, W. R. Grace & Co.; DCI-S.
    - d. Sika Corporation; FerroGard 901.

## 2.6 WATERSTOPS

- A. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Carlisle Coatings & Waterproofing, Inc.; MiraSTOP.
    - b. CETCO; Volclay Waterstop-RX.
    - c. Concrete Sealants Inc.; Conseal CS-231.
    - d. Greenstreak; Swellstop.
    - e. Henry Company, Sealants Division; Hydro-Flex.
    - f. JP Specialties, Inc.; Earth Shield Type 20.

## 2.7 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Carlisle Coatings & Waterproofing, Inc.; Blackline 400.
    - b. Fortifiber Building Systems Group; Moistop Ultra 15.
    - c. Grace Construction Products, W. R. Grace & Co.; Florprufe 120.
    - d. Insulation Solutions, Inc.; Viper VaporCheck 16.
    - e. Meadows, W. R., Inc.; Perminator 15 mil.
    - f. Raven Industries Inc.; Vapor Block 15.
    - g. Reef Industries, Inc.; Griffolyn 15 mil Green.
    - h. Stego Industries, LLC; Stego Wrap 15 mil Class A.
- B. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils thick.
- C. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size #5, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

## 2.8 LIQUID FLOOR TREATMENTS

- A. VOC Content: Liquid floor treatments shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).



B. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

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

- a. ChemMasters; Chemisil Plus.
- b. ChemTec Int'l; ChemTec One.
- c. Conspec by Dayton Superior; Intraseal.
- d. Curecrete Distribution Inc.; Ashford Formula.
- e. Dayton Superior Corporation; Day-Chem Sure Hard (J-17).
- f. Edoco by Dayton Superior; Titan Hard.
- g. Euclid Chemical Company (The), an RPM company; Euco Diamond Hard.
- h. Kaufman Products, Inc.; SureHard.
- i. L&M Construction Chemicals, Inc.; Seal Hard.
- j. Meadows, W. R., Inc.; LIQUI-HARD.
- k. Metalcrete Industries; Floorsaver.
- l. Nox-Crete Products Group; Duro-Nox.
- m. Symons by Dayton Superior; Buff Hard.
- n. US SPEC, Division of US Mix Products Company; US SPEC Industraseal.
- o. Vexcon Chemicals, Inc.; Vexcon StarSeal PS Clear.

C. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.

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

- a. Advanced Floor Products; Retro-Plate 99.
- b. L&M Construction Chemicals, Inc.; FGS Hardener Plus.
- c. QuestMark, a division of CentiMark Corporation; DiamondQuest Densifying Impregnator Application.

## 2.9 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

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

- a. Axim Italcementi Group, Inc.; CATEXOL CimFilm.
- b. BASF Construction Chemicals - Building Systems; Confilm.
- c. ChemMasters; SprayFilm.
- d. Conspec by Dayton Superior; Aquafilm.
- e. Dayton Superior Corporation; Sure Film (J-74).
- f. Edoco by Dayton Superior; BurkeFilm.
- g. Euclid Chemical Company (The), an RPM company; Eucobar.

- h. Kaufman Products, Inc.; Vapor-Aid.
  - i. Lambert Corporation; LAMBCO Skin.
  - j. L&M Construction Chemicals, Inc.; E-CON.
  - k. Meadows, W. R., Inc.; EVAPRE.
  - l. Metalcrete Industries; Waterhold.
  - m. Nox-Crete Products Group; MONOFILM.
  - n. Sika Corporation; SikaFilm.
  - o. SpecChem, LLC; Spec Film.
  - p. Symons by Dayton Superior; Finishing Aid.
  - q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
  - r. Unitex; PRO-FILM.
  - s. Vexcon Chemicals, Inc.; Certi-Vex Envio Set.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. BASF Construction Chemicals - Building Systems; Kure 1315.
    - b. ChemMasters; Polyseal WB.
    - c. Conspec by Dayton Superior; Sealcure 1315 WB.
    - d. Edoco by Dayton Superior; Cureseal 1315 WB.
    - e. Euclid Chemical Company (The), an RPM company; Super Diamond Clear VOX; LusterSeal WB 300.
    - f. Kaufman Products, Inc.; Sure Cure 25 Emulsion.
    - g. Lambert Corporation; UV Safe Seal.
    - h. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
    - i. Meadows, W. R., Inc.; Vocomp-30.
    - j. Metalcrete Industries; Metcure 30.
    - k. Right Pointe; Right Sheen WB30.
    - l. Symons by Dayton Superior; Cure & Seal 31 Percent E.
    - m. Vexcon Chemicals, Inc.; Vexcon Starseal 1315.
  - 2. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 2.10 RELATED MATERIALS
- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.

- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 aromatic polyurea with a Type A shore durometer hardness range of 90 to 95 per ASTM D 2240.
- C. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
  - 1. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- E. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

## 2.11 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
  - 1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
  - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
  - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
  - 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
  - 1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
  - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
  - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
  - 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

## 2.12 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
  - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Use fly ash as needed to reduce the total amount of Portland cement, which would otherwise be used, by not more than 25 percent. Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:
  - 1. Fly Ash: 25 percent.
- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
  - 1. Use water-reducing or high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
  - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
  - 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
  - 4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.
- E. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

## 2.13 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings and foundation walls: Proportion normal-weight concrete mixture as follows:
  - 1. Minimum Compressive Strength: 3500 psi at 28 days.
  - 2. Slump Limit: 5 inches.
- B. Interior Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
  - 1. Minimum Compressive Strength: 3500 psi at 28 days.
  - 2. Slump Limit: 5 inches, plus or minus 1 inch.
  - 3. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.

C. Exterior Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3500 psi at 28 days.
2. Slump Limit: 5 inches.
3. Air Content: 6 percent, plus or minus one percent at point of delivery for 1-inch nominal maximum aggregate size.

2.14 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.15 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M, and furnish batch ticket information.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
1. Class A, 1/8 inch for smooth-formed finished surfaces.
  2. Class B, 1/4 inch for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
1. Install keyways, reglets, recesses, and the like, for easy removal.
  2. Do not use rust-stained steel form-facing material.

- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

### 3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
  - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
  - 3. Install dovetail anchor slots in concrete structures as indicated.

### 3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.

- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

### 3.4 VAPOR RETARDERS

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
  - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.
  - 2. Seal all penetrations
  - 3. Turn vapor barrier up at all vertical walls and secure to wall with a termination bar
- B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder according to manufacturer's written instructions.

### 3.5 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
  - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
  - 1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
- F. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

### 3.6 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
  - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
  - 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
  - 3. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
  - 4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
  - 5. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
  - 1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
  - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
  - 1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
  - 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 07920 "Joint Sealants," are indicated.
  - 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

### 3.7 WATERSTOPS

- A. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.



### 3.8 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
  - 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
  - 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
  - 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- D. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
  - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  - 2. Maintain reinforcement in position on chairs during concrete placement.
  - 3. Screed slab surfaces with a straightedge and strike off to correct elevations.
  - 4. Slope surfaces uniformly to drains where required.
  - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
  - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
  - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

F. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.9 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.10 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
1. Apply scratch finish to surfaces to receive mortar setting beds for bonded cementitious floor finishes.
- C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
1. Apply float finish to surfaces to receive trowel finish.

- D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighen until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
  - 1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
  - 2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
    - a. Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 17; and of levelness, F(L) 15.
    - b. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
    - c. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.
    - d. Specified overall values of flatness, F(F) 45; and of levelness, F(L) 35; with minimum local values of flatness, F(F) 30; and of levelness, F(L) 24.
- E. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
  - 1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- F. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
  - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

### 3.11 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations:
  - 1. Coordinate sizes and locations of concrete bases with actual equipment provided.

2. Construct concrete bases 4 inches high unless otherwise indicated; and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
  3. Minimum Compressive Strength: 4000 psi at 28 days.
  4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
  5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor into structural concrete substrate.
  6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  7. Cast anchor-bolt insert into bases. Install anchor bolts to elevations required for proper attachment to supported equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

### 3.12 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
  1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
  - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
  - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
  - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
  - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

### 3.13 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
  1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
  2. Do not apply to concrete that is less than 14 days' old.
  3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.
- B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

### 3.14 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
  - 1. Defer joint filling until concrete has aged at least one month(s). Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

### 3.15 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
  - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
  - 2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
  - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
  - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.

2. After concrete has cured at least 14 days, correct high areas by grinding.
  3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
  4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
  5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
  6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
  7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

### 3.16 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- C. Inspections:
1. Steel reinforcement placement.
  2. Headed bolts and studs.
  3. Verification of use of required design mixture.
  4. Concrete placement, including conveying and depositing.
  5. Curing procedures and maintenance of curing temperature.
  6. Verification of concrete strength.

- D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
  2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
    - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
  3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
  4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
  5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
  6. Compression Test Specimens: ASTM C 31/C 31M.
    - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
  7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
    - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
    - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
  8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
  9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
  10. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.



11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.17 PROTECTION OF LIQUID FLOOR TREATMENTS

- A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

3.18 CONCRETE WASTE DISPOSAL

- A. Do not discharge concrete washout into storm drains, catch basins or to the sanitary sewer system. Perform washing of concrete trucks in designated areas or an approved offsite location.
- B. Designated areas should be clearly labeled. They should be in a pit to prevent run-off of waste water. Place designated areas a minimum of 50 feet from storm drains, bodies of water and ditches. All designated areas should be lined to prevent seepage and should have a barrier.
- C. Alternative to a designated area: Provide a concrete box. If only a small amount of concrete washing is to occur, one option is to line a roll-off box. For very small projects this could be done with a drum.
- D. Once concrete washout has hardened, break up and dispose of properly. Disposal of hardened concrete should occur on a regular basis.
- E. Washout facilities must be cleaned, or new facilities provided once the washout area is 75% full.

END OF SECTION 03 3000

## SECTION 03 3543 - POLISHED CONCRETE FINISHING

### 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 polished concrete finishing, including staining.
  - 1. Concrete for polished concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, initial finishing, and curing is specified in Section 03 3000 "Cast-in-Place Concrete."
- B. Related Requirements:
  - 1. Section 03 3000 "Cast-in-Place Concrete" for concrete not designated as polished concrete.

#### 1.3 DEFINITIONS

- A. Design Reference Sample: Sample designated by Architect in the Contract Documents that reflects acceptable surface quality and appearance of polished concrete.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: For each type of exposed color.

#### 1.5 QUALITY ASSURANCE

- A. Field Sample Panels: After approval of verification sample and before casting concrete, produce field sample panels to demonstrate the approved range of selections made under Sample submittals. Produce a minimum of three sets of full-scale panels, approximately 48 by 48 inches minimum, to demonstrate the expected range of finish, color, and appearance variations.
  - 1. Locate panels as indicated or, if not indicated, as directed by Architect.

1.6 FIELD CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 STAIN MATERIALS

- A. Reactive Stain: Acidic-based stain with wetting agents and high-grade, UV-stable metallic salts that react with calcium hydroxide in cured concrete to produce permanent, variegated, or translucent color effects.

2.2 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatments for Polished Concrete Finish: Clear, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; that penetrates, hardens, and is suitable for polished concrete surfaces.

2.3 MATERIALS AND MANUFACTURERS

- A. Hardening/Sealing Agent, Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1. Retro-Plate 99, manufactured by Advanced Floor Products, Inc., P.O. Box 50533, Provo, Utah 84605, 801-812-3420 or approved equal.
  - a. Performance Criteria:
    - 1) Abrasion Resistance: ASTM C779 Ó Up to 400% increase in abrasion resistance.
    - 2) Impact Strength: ASTM C805 Ó Up to 21% increase impact strength.
    - 3) Ultra Violet Light and Water Spray: ASTM G23-81 Ó No adverse effect to ultra violet and water spray.
    - 4) Reflectivity: Up to 30% increase in reflectivity.
  - b. Grinding Level:
    - 1) Cream - No exposed aggregate.

B. Dye:

1. Ameripolish Concrete Dye. Polish to be approved by Retro-plate and applied in sequence as approved by the qualified installer. Provide samples in an area to be covered prior to polishing exposed areas.
  - a. Color: Salt and Pepper.

PART 3 - EXECUTION

3.1 POLISHING

- A. Polish: Level 2: Low sheen, 400 grit.
- B. Apply polished concrete finish system to cured and prepared slabs to match accepted mockup.
  1. Machine grind floor surfaces to receive polished finishes level and smooth and to depth required to reveal aggregate to match approved mockup.
  2. Apply reactive stain for polished concrete in polishing sequence and according to manufacturer's written instructions.
  3. Apply penetrating liquid floor treatment for polished concrete in polishing sequence and according to manufacturer's written instructions, allowing recommended drying time between successive coats.
  4. Apply penetrating stain for polished concrete in polishing sequence and according to manufacturer's written instructions.
  5. Continue polishing with progressively finer-grit diamond polishing pads to gloss level, to match approved mockup.
  6. Control and dispose of waste products produced by grinding and polishing operations.
  7. Neutralize and clean polished floor surfaces.

3.2 STAINING

- A. Newly placed concrete shall be at least 14 days old before staining.
- B. Prepare surfaces according to manufacturer's written instructions and as follows:
  1. Clean concrete thoroughly by scraping, applying solvents or stripping agents, sweeping and pressure washing, or scrubbing with a rotary floor machine and detergents recommended by stain manufacturer. Rinse until water is clear and allow surface to dry.
  2. Test surfaces with droplets of water. If water beads and does not penetrate surface, or penetrates only in some areas, profile surfaces by . Retest and continue profiling surface until water droplets immediately darken and uniformly penetrate concrete surfaces.

3. Neutralize concrete surfaces and rinse until water is clear. Test surface for residue with clean white cloth. Test surface according to ASTM F 710 to ensure pH is between 7 and 8.

END OF SECTION 03 3543

## SECTION 04 2000 - UNIT MASONRY

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

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

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

1. Cast-stone trim in unit masonry.
2. Steel lintels in unit masonry.
3. Steel shelf angles for supporting unit masonry.

- C. Related Requirements:

1. Section 05 1200 "Structural Steel Framing" for installing anchor sections of adjustable masonry anchors for connecting to structural steel frame.
2. Section 07 2100 "Thermal Insulation" for cavity wall insulation.
3. Section 07 6200 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

#### 1.3 DEFINITIONS

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

#### 1.4 ACTION SUBMITTALS

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

B. Shop Drawings: For the following:

1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Stone Trim Units: Show sizes, profiles, and locations of each stone trim unit required.
3. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.
4. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Verification: For each type and color of the following:

1. Clay face brick, in the form of straps of five or more bricks.
2. Special brick shapes.
3. Weep holes.
4. Accessories embedded in masonry.

1.5 INFORMATIONAL SUBMITTALS

A. Material Certificates: For each type and size of the following:

1. Masonry units.
  - a. Include material test reports substantiating compliance with requirements.
  - b. For brick, include size-variation data verifying that actual range of sizes falls within specified tolerances.
  - c. For masonry units used in structural masonry, include data and calculations establishing average net-area compressive strength of units.
2. Cementitious materials. Include name of manufacturer, brand name, and type.
3. Grout mixes. Include description of type and proportions of ingredients.
4. Reinforcing bars.
5. Joint reinforcement.
6. Anchors, ties, and metal accessories.

B. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.

C. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.

D. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

## 1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
  - 1. Build mockup of typical wall area as shown on Drawings.
  - 2. Build mockups for typical exterior wall in sizes approximately 48 inches long by 36 inches high by full thickness, including face and backup wythes and accessories.
    - a. Include a sealant-filled joint at least 16 inches long in exterior wall mockup.
    - b. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).
    - c. Include metal studs, sheathing, water-resistive barrier, veneer anchors, flashing, cavity drainage material, and weep holes in exterior masonry-veneer wall mockup.
  - 3. Clean one-half of exposed faces of mockups with masonry cleaner as indicated.
  - 4. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.

## 1.7 DELIVERY, STORAGE, AND HANDLING

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



## 1.8 FIELD CONDITIONS

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

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

- B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days.
  - 1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.
  - 2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

## 2.3 UNIT MASONRY, GENERAL

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

## 2.4 CONCRETE MASONRY UNITS

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
  - 1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
  - 2. Provide square-edged units for outside corners unless otherwise indicated.
- B. CMUs: ASTM C 90.
  - 1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi.
  - 2. Density Classification: Medium weight.
  - 3. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.

C. Concrete Building Brick: ASTM C 55.

1. Density Classification: Medium weight.
2. Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.

2.5 MASONRY LINTELS

- A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.6 BRICK

- A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:
1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
  2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
  3. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.
  4. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.
- B. Clay Face Brick: Facing brick complying with ASTM C 216 or hollow brick complying with ASTM C 652, Class H40V (void areas between 25 and 40 percent of gross cross-sectional area).
1. Basis-of-Design Products: Subject to compliance with requirements, provide the following:
    - a. B-1 and B-2: Interstate Brick Arctic White. B-3 Endicott Clay Products Manganese Brown Velour Modular.
  2. Grade: SW.
  3. Type: FBX.
  4. Initial Rate of Absorption: Less than 30 g/30 sq. in. per minute when tested according to ASTM C 67.
  5. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
  6. Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.

## 2.7 MORTAR AND GROUT MATERIALS

- A. Portland Cement: ASTM C 150/C 150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
  - 1. Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.
- B. Hydrated Lime: ASTM C 207, Type S.
- C. Aggregate for Mortar: ASTM C 144.
  - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
  - 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
- D. Aggregate for Grout: ASTM C 404.
- E. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. BASF Corporation-Construction Systems
    - b. Euclid Chemical Company (The); an RPM company; Accelguard 80.
    - c. Grace Construction Products; W.R. Grace & Co. -- Conn.; Morset.
- F. Water: Potable.

## 2.8 REINFORCEMENT

- A. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Dur-O-Wal; a Hohmann & Barnard company; D/A 810, D/A 812 or D/A 817.
    - b. Heckmann Building Products, Inc.; No. 376 Rebar Positioner.
    - c. Hohmann & Barnard, Inc; #RB or #RB-Twin Rebar Positioner.
    - d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

- B. Masonry-Joint Reinforcement, General: ASTM A 951/A 951M.
  - 1. Interior Walls: Mill- Hot-dip galvanized carbon steel.
  - 2. Exterior Walls: Hot-dip galvanized carbon Stainless steel.
  - 3. Wire Size for Side Rods: 0.148-inch diameter.
  - 4. Wire Size for Cross Rods: 0.148-inch diameter.
  - 5. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
  - 6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.
- C. Masonry-Joint Reinforcement for Single-Wythe Masonry: Ladder or truss type with single pair of side rods.
- D. Masonry-Joint Reinforcement for Multiwythe Masonry:

## 2.9 TIES AND ANCHORS

- A. General: Ties and anchors shall extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.
- B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
  - 1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.
  - 2. Galvanized-Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 zinc coating.
  - 3. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
  - 4. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.
- C. Individual Wire Ties: Rectangular units with closed ends and not less than 4 inches wide.
  - 1. Z-shaped ties with ends bent 90 degrees to provide hooks not less than 2 inches long may be used for masonry constructed from solid units.
  - 2. Where wythes do not align, use adjustable ties with pintle-and-eye connections having a maximum adjustment of 1-1/4 inches.
- D. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
  - 1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter, hot-dip galvanized steel stainless-steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.
  - 2. Tie Section: Triangular-shaped wire tie made from 0.25-inch- diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.

- E. Partition Top Anchors: 0.105-inch- thick metal plate with a 3/8-inch- diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.
- F. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.
  - 1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153/A 153M.
- G. Adjustable Masonry-Veneer Anchors:
  - 1. General: Provide anchors that allow vertical adjustment but resist a 100-lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
  - 2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.105-inch- thick steel sheet, galvanized after fabrication.
  - 3. Fabricate wire ties from 0.187-inch- diameter, hot-dip galvanized-steel wire unless otherwise indicated.
  - 4. Screw-Attached, Masonry-Veneer Anchors: Wire tie and a rib-stiffened, sheet metal anchor section with screw holes top and bottom, with a projecting vertical tab having a slotted hole for inserting wire tie.
    - 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) FERRO Corporation; Slotted Heavy Duty Rap-TieSlotted Rap-Tie.
      - 2) Hohmann & Barnard, Inc; BL-407.
  - 5. Screw-Attached, Masonry-Veneer Anchors: Wire tie and a rib-stiffened, sheet metal anchor section with screw holes top and bottom, with projecting tabs having holes for inserting vertical legs of wire tie formed to fit anchor section.
    - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) Heckmann Building Products, Inc.; 213 with 282.
      - 2) Hohmann & Barnard, Inc; HB-200-X.
      - 3) Wire-Bond; RJ-711.
  - 6. Screw-Attached, Masonry-Veneer Anchors: Wire tie and a sheet metal anchor section, 1-1/4 inches wide by 6 inches long, with screw holes top and bottom and with raised rib-stiffened strap, 5/8 inch wide by 3-5/8 inches long, stamped into center to provide a slot between strap and base for inserting wire tie.
    - 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) Heckmann Building Products, Inc.; 315-D with 316.

- 2) Hohmann & Barnard, Inc; DW-10HS.
  - 3) Wire-Bond; 1004, Type III.
7. Screw-Attached, Masonry-Veneer Anchors: Wire tie and a gasketed sheet metal anchor section, 1-1/4 inches wide by 6 inches long, with screw holes top and bottom; top and bottom ends bent to form pronged legs of length to match thickness of insulation or sheathing; and raised rib-stiffened strap, 5/8 inch wide by 6 inches long, stamped into center to provide a slot between strap and base for inserting wire tie. Self-adhering, modified bituminous gasket fits behind anchor plate and extends beyond pronged legs.
- 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) Hohmann & Barnard, Inc; DW-10-X.
    - 2) Wire-Bond; 1004X, Type III X.
8. Stainless-Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads; either made from Type 410 stainless steel or made with a carbon-steel drill point and 300 Series stainless-steel shank.

## 2.10 EMBEDDED FLASHING MATERIALS

### A. Flexible Flashing: Use one of the following unless otherwise indicated:

1. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester-reinforced ethylene interpolymer alloy.
  - 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) Du Pont; Thru-Wall Flashing.
    - 2) Hohmann & Barnard, Inc; Flex-Flash.
    - 3) Hyload, Inc.; Hyload Cloaked Flashing System.
    - 4) Mortar Net USA, Ltd; Total Flash.
  - b. Monolithic Sheet: Elastomeric thermoplastic flashing, 0.040 inch thick.
  - c. Self-Adhesive Sheet with Drip Edge: Elastomeric thermoplastic flashing, 0.025 inch thick, with a 0.015-inch- thick coating of rubberized-asphalt adhesive. Where flashing extends to face of masonry, rubberized-asphalt coating is held back approximately 1-1/2 inches from edge.
  - d. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

### B. Application: Unless otherwise indicated, use the following:

1. Where flashing is indicated to receive counterflashing, use metal flashing.

2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
  3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing or flexible flashing with a metal drip edge.
  4. Where flashing is fully concealed, use flexible flashing.
- C. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.
- D. Termination Bars for Flexible Flashing: Stainless-steel sheet 0.019 inch by 1-1/2 inches with a 3/8 inch sealant flange at top.

## 2.11 MISCELLANEOUS MASONRY ACCESSORIES

- A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.
- B. Preformed Control-Joint Gaskets: Made from [styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805] [or] [PVC, complying with ASTM D 2287, Type PVC-65406] and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).
- D. Weep/Cavity Vent Products: Use the following unless otherwise indicated:
1. Cellular Plastic Weep/Vent: One-piece, flexible extrusion made from UV-resistant polypropylene copolymer, full height and width of head joint and depth 1/8 inch less than depth of outer wythe, in color selected from manufacturer's standard.
    - 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) Advanced Building Products Inc.; Mortar Maze Cell Vent.
      - 2) Hohmann & Barnard, Inc; QV Quadro-Vent.
      - 3) Wire-Bond; Cell Vent.
- E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Advanced Building Products Inc.; Mortar Break.
    - b. CavClear/Archovations, Inc.; CavClear Masonry Mat.
    - c. Heckmann Building Products, Inc.; Weep-Thru Mortar Deflector.
    - d. Hohmann & Barnard, Inc; Mortar Trap.



- e. Mortar Net USA, Ltd; Mortar Net.

2. Configuration: Provide one of the following:

- a. Strips, full depth of cavity and 10 inches high, with dovetail-shaped notches 7 inches deep that prevent clogging with mortar droppings.

2.12 MASONRY CLEANERS

- A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Diedrich Technologies, Inc.; a division of Sandell Construction Solutions.
- b. EaCo Chem, Inc.
- c. PROSOCO, Inc.

2.13 MORTAR AND GROUT MIXES

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

- 1. Do not use calcium chloride in mortar or grout.
- 2. Use portland cement-lime mortar unless otherwise indicated.
- 3. For exterior masonry, use portland cement-lime mortar.
- 4. For reinforced masonry, use portland cement-lime mortar.
- 5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

- B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

- C. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

- 1. For masonry below grade or in contact with earth, use Type M.
- 2. For reinforced masonry, use Type S.
- 3. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type S.

4. For interior nonload-bearing partitions, Type O may be used instead of Type N.
- D. Grout for Unit Masonry: Comply with ASTM C 476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
  2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 2000 psi.
  3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
  2. Verify that foundations are within tolerances specified.
  3. Verify that reinforcing dowels are properly placed.
  4. Verify that substrates are free of substances that impair mortar bond.
- B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION, GENERAL

- A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.
- B. Build chases and recesses to accommodate items specified in this and other Sections.
- C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures. Mix units from several pallets or cubes as they are placed.

- F. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested according to ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

### 3.3 TOLERANCES

A. Dimensions and Locations of Elements:

1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:

1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
3. For vertical lines and surfaces, do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet or 1/2-inch maximum.
7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:

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

### 3.4 LAYING MASONRY WALLS

- A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.
- B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in bond pattern indicated on Drawings; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.
- H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- I. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
  - 1. Install compressible filler in joint between top of partition and underside of structure above.
  - 2. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 07 8443 "Joint Firestopping."

### 3.5 MORTAR BEDDING AND JOINTING

- A. Lay hollow brick CMUs as follows:
  - 1. Bed face shells in mortar and make head joints of depth equal to bed joints.
  - 2. Bed webs in mortar in all courses of piers, columns, and pilasters.
  - 3. Bed webs in mortar in grouted masonry, including starting course on footings.

4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.
  5. Fully bed units and fill cells with mortar at anchors and ties as needed to fully embed anchors and ties in mortar.
- B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.
- C. Lay structural clay tile as follows:
1. Lay vertical-cell units with full head joints unless otherwise indicated. Provide bed joints with full mortar coverage on face shells and webs.
  2. Lay horizontal-cell units with full bed joints unless otherwise indicated. Keep drainage channels, if any, free of mortar. Form head joints with sufficient mortar so excess will be squeezed out as units are placed in position. Butter both sides of units to be placed, or butter one side of unit already in place and one side of unit to be placed.
  3. Maintain joint thicknesses indicated except for minor variations required to maintain bond alignment. If not indicated, lay walls with 1/4- to 3/8-inch- thick joints.
- D. Set trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
  2. Allow cleaned surfaces to dry before setting.
  3. Wet joint surfaces thoroughly before applying mortar.
- E. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- F. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.
- G. Cut joints flush where indicated to receive air barriers unless otherwise indicated.
- 3.6 ANCHORED MASONRY VENEERS
- A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:
1. Fasten screw-attached anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
  2. Embed connector sections and continuous wire in masonry joints.
  3. Locate anchor sections to allow maximum vertical differential movement of ties up and down.

4. Space anchors as indicated, but not more than 18 inches o.c. vertically and 24 inches o.c. horizontally, with not less than one anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around perimeter.
- B. Provide not less than 1 inch of airspace between back of masonry veneer and face of sheathing or insulation.
1. Keep airspace clean of mortar droppings and other materials during construction. Bevel beds away from airspace, to minimize mortar protrusions into airspace. Do not attempt to trowel or remove mortar fins protruding into airspace.

### 3.7 MASONRY-JOINT REINFORCEMENT

- A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
1. Space reinforcement not more than 16 inches o.c.
  2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
  3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.
- B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.
- C. Provide continuity at wall intersections by using prefabricated T-shaped units.
- D. Provide continuity at corners by using prefabricated L-shaped units.
- E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

### 3.8 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

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

### 3.9 CONTROL AND EXPANSION JOINTS

- A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:
  - 1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
  - 2. Install preformed control-joint gaskets designed to fit standard sash block.
  - 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.
  - 4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.
- C. Form expansion joints in brick as follows:
  - 1. Build in compressible joint fillers where indicated.
  - 2. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Section 07 9200 "Joint Sealants."
- D. Provide horizontal, pressure-relieving joints by either leaving an airspace or inserting a compressible filler of width required for installing sealant and backer rod specified in Section 07 9200 "Joint Sealants," but not less than 3/8 inch.
  - 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

### 3.10 LINTELS

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

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

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install cavity vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

- B. Install flashing as follows unless otherwise indicated:
1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
  2. At multiwythe masonry walls, including cavity walls, extend flashing through outer wythe, turned up a minimum of 4 inches, and 1-1/2 inches into the inner wythe.[ Form 1/4-inch hook in edge of flashing embedded in inner wythe.]
  3. At masonry-veneer walls, extend flashing through veneer, across airspace behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under air barrier, lapping at least 4 inches.
  4. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
  5. Install stainless steel metal drip edges with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 07 9200 "Joint Sealants" for application indicated.
- C. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.
- D. Install weep holes in exterior wythes and veneers in head joints of first course of masonry immediately above embedded flashing.
1. Use specified weep/cavity vent products to form weep holes.
  2. Space weep holes 24 inches o.c. unless otherwise indicated.
  3. Trim wicking material flush with outside face of wall after mortar has set.
- E. Place cavity drainage material in airspace behind veneers to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

### 3.12 REINFORCED UNIT MASONRY INSTALLATION

- A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
  2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and that of other loads that may be placed on them during construction.
- B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.



- C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
  - 1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
  - 2. Limit height of vertical grout pours to not more than 60 inches.

### 3.13 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
  - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
  - 2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
  - 3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
  - 4. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
  - 5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.
  - 6. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

### 3.14 MASONRY WASTE DISPOSAL

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

END OF SECTION 04 2000

## SECTION 04 7200 - CAST STONE MASONRY

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Cast-stone trim.
- B. Related Sections:
  - 1. Section 04 2000 "Unit Masonry" for installing cast-stone units in unit masonry.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. For cast-stone units, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details for cast-stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.
  - 1. Include building elevations showing layout of units and locations of joints and anchors.
- C. Samples for Initial Selection: For colored mortar.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Material Test Reports: For each mix required to produce cast stone, based on testing according to ASTM C 1364, including test for resistance to freezing and thawing.
  - 1. Provide test reports based on testing within previous two years.

## 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer of cast-stone units similar to those indicated for this Project, that has sufficient production capacity to manufacture required units, and is a plant certified by the Cast Stone Institute the Architectural Precast Association or the Precast/Prestressed Concrete Institute for Group A, Category AT.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Build mockup of typical wall area as shown on Drawings.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Coordinate delivery of cast stone with unit masonry work to avoid delaying the Work.
- B. Pack, handle, and ship cast-stone units in suitable packs or pallets.
  - 1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast-stone units if required, using dollies with wood supports.
  - 2. Store cast-stone units on wood skids or pallets with nonstaining, waterproof covers, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.
- C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- D. Store mortar aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

## 1.7 PROJECT CONDITIONS

- A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements in TMS 602/ACI 530.1/ASCE 6.
  - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until cast stone has dried, but no fewer than seven days after completing cleaning.
- B. Hot-Weather Requirements: Comply with hot-weather construction requirements in TMS 602/ACI 530.1/ASCE 6.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations for Cast Stone: Obtain cast-stone units from single source from single manufacturer.

### 2.2 CAST-STONE MATERIALS

- A. General: Comply with ASTM C 1364.
- B. Portland Cement: ASTM C 150/C 150M, Type I or Type III, containing not more than 0.60 percent total alkali when tested according to ASTM C 114. Provide natural color or white cement as required to produce cast-stone color indicated.

### 2.3 CAST-STONE UNITS

- A. Cast-Stone Units: Comply with ASTM C 1364.
  - 1. Units shall be manufactured using the vibrant dry tamp or wet-cast method.
  - 2. Units shall be resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666/C 666M, Procedure A, as modified by ASTM C 1364.
- B. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.
  - 1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
  - 2. Provide drips on projecting elements unless otherwise indicated.
- C. Fabrication Tolerances:
  - 1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch.
  - 2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch, whichever is greater, but in no case by more than 1/4 inch.
  - 3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch, whichever is greater.
  - 4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch on formed surfaces of units and 3/8 inch on unformed surfaces.
- D. Cure Units as Follows:
  - 1. Cure units in enclosed, moist curing room at 95 to 100 percent relative humidity and temperature of 100 deg F for 12 hours or 70 deg F for 16 hours.

- E. Colors and Textures: As selected by Architect from manufacturer's full range.
- F. Colors and Textures: Provide units with fine-grained texture and buff color resembling smooth-finished Indiana limestone.

## 2.4 MORTAR MATERIALS

- A. Provide mortar materials that comply with Section 04 2000 "Unit Masonry."
- B. Aggregate for Mortar: ASTM C 144.
  - 1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
  - 2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
- C. Water: Potable.

## 2.5 ACCESSORIES

- A. Anchors: Type and size indicated, fabricated from Type 304 stainless steel complying with ASTM A 240/A 240M, ASTM A 276, or ASTM A 666.
- B. Dowels: 1/2-inch- diameter round bars, fabricated from .

## 2.6 MORTAR MIXES

- A. Comply with requirements in Section 04 2000 "Unit Masonry" for mortar mixes.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 SETTING CAST STONE IN MORTAR

- A. Install cast-stone units to comply with requirements in Section 04 2000 "Unit Masonry."

3.3 ADJUSTING AND CLEANING

- A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.
- B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.
- C. In-Progress Cleaning: Clean cast stone as work progresses.
  - 1. Remove mortar fins and smears before tooling joints.
  - 2. Remove excess sealant immediately, including spills, smears, and spatter.
- D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:
  - 1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
  - 2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of cast stone.
  - 3. Clean cast stone by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.

END OF SECTION 04 7200

## SECTION 05 1200 - STRUCTURAL STEEL FRAMING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. The Drawings and the general provisions of the Contract, Standard General Conditions, Supplementary Conditions, Special Conditions, and other Division 01 Specification Sections, apply to each section of this Project's specifications.

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Structural steel.
  - 2. Grout.

#### 1.3 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- B. Heavy Sections: Rolled and built-up sections as follows:
  - 1. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches.
  - 2. Column base plates thicker than 2 inches.

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

#### 1.5 PERFORMANCE REQUIREMENTS

- A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering analysis by a qualified professional engineer registered in the state of Nebraska to withstand loads indicated and comply with other information and restrictions indicated. Only beam connections with loads indicated are to be engineered under this section. Beams without loads indicated are to be detailed using the standard and special connection details shown in the contract documents.
  - 1. Select and complete connections using schematic details indicated and AISC 360.

## 1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show fabrication of structural-steel components.
  - 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
  - 2. Include embedment Drawings.
  - 3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
  - 4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
- C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:
  - 1. Power source (constant current or constant voltage).
  - 2. Electrode manufacturer and trade name, for demand critical welds.

## 1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, fabricator, testing agency.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Mill test reports for structural steel, including chemical and physical properties.
- E. Product Test Reports: For the following:
  - 1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
  - 2. Tension-control, high-strength, bolt-nut-washer assemblies.
  - 3. Shop primers.
  - 4. Nonshrink grout.
- F. Source quality-control reports.
- G. Field quality-control and special inspection reports.

## 1.8 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD and with a record of 10 years of fabricating similar buildings.



- B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACSE and with a record of 10 years of erecting similar buildings.
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - 1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8/D1.8M. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.
- D. Comply with applicable provisions of the following specifications and documents:
  - 1. AISC 303.
  - 2. AISC 341 and AISC 341s1.
  - 3. AISC 360.
  - 4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
  - 1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
  - 1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
  - 2. Clean and relubricate bolts and nuts that become dry or rusty before use.
  - 3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

### PART 2 - PRODUCTS

#### 2.1 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A 992/A 992M
- B. Channels, Angles, M Shapes: ASTM A 36/A 36M
- C. Plate and Bar: ASTM A 36/A 36M

- D. Cold-Formed Hollow Structural Sections: ASTM A 500/A 500M, Grade B, structural tubing.
- E. Steel Pipe: ASTM A 53/A 53M, Type E or Type S, Grade B.
  - 1. Weight Class: as indicated on drawings.
  - 2. Finish: Black.
- F. Welding Electrodes: Comply with AWS requirements.

## 2.2 BOLTS, CONNECTORS, AND ANCHORS

- A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, heavy-hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.
- B. Headed Anchor Rods: ASTM F 1554, Grade 36 straight.
  - 1. Nuts: ASTM A 563 heavy-hex carbon steel.
  - 2. Plate Washers: ASTM A 36/A 36M carbon steel.
  - 3. Washers: ASTM F 436, Type 1, hardened carbon steel.
  - 4. Finish: Plain.
- C. Threaded Rods: ASTM A 36/A 36M.
  - 1. Nuts: ASTM A 563 heavy-hex carbon steel.
  - 2. Washers: ASTM F 436, Type 1, hardened ASTM A 36/A 36M carbon steel.
  - 3. Finish: Plain

## 2.3 PRIMER

- A. Low-Emitting Materials: Interior application of paints and coatings shall comply with VOC limits listed in Specification Section 01 8113 – Sustainable Design Requirements.
- B. Primer: Comply with Division 09 Sections "Exterior Painting" and "Interior Painting."
- C. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.
- D. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20 ASTM A 780/A 780M.

## 2.4 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

## 2.5 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.
  - 1. Fabricate beams with rolling camber up.
  - 2. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
  - 3. Mark and match-mark materials for field assembly.
  - 4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
  - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning."
- F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.
- G. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
  - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
  - 2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
  - 3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

## 2.6 SHOP CONNECTIONS

- A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type: Snug tightened.

- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  - 1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

## 2.7 SHOP PRIMING

- A. Shop prime steel surfaces except the following:
  - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
  - 2. Surfaces to be field welded.
  - 3. Galvanized surfaces.
  - 4. Surfaces enclosed in interior construction.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
  - 1. SSPC-SP 2, "Hand Tool Cleaning."
  - 2. SSPC-SP 3, "Power Tool Cleaning."
  - 3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
  - 4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
  - 5. SSPC-SP 14/NACE No. 8, "Industrial Blast Cleaning."
  - 6. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 7. SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning."
  - 8. SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning."
  - 9. SSPC-SP 8, "Pickling."
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
  - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
  - 2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.
- D. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

## 2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
  - 1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
  - 2. Galvanize lintels and shelf angles exposed to weather after fabrication.

## 2.9 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.
  - 1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
- B. Bolted Connections: Inspect shop-bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- C. Welded Connections: Visually inspect shop-welded connections according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
  - 1. Liquid Penetrant Inspection: ASTM E 165.
  - 2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
  - 3. Ultrasonic Inspection: ASTM E 164.
  - 4. Radiographic Inspection: ASTM E 94.
- D. In addition to visual inspection, test and inspect shop-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
  - 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
  - 2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.
- E. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
  - 1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

### 3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.
- B. Baseplates Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
  - 1. Set plates for structural members on wedges, shims, or setting nuts as required.
  - 2. Weld plate washers to top of baseplate.
  - 3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
  - 4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- C. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
  - 1. Level and plumb individual members of structure.
  - 2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- E. Splice members only where indicated.
- F. Do not use thermal cutting during erection.
- G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

- H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

### 3.4 FIELD CONNECTIONS

- A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
  - 1. Joint Type: Snug tightened.
- B. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  - 1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
  - 2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.

### 3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
  - 1. Verify structural-steel materials and inspect steel frame joint details.
  - 2. Verify weld materials and inspect welds.
  - 3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Bolted Connections: Inspect bolted connections according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
- D. Welded Connections: Visually inspect field welds according to AWS D1.1/D1.1M.
  - 1. In addition to visual inspection, test and inspect field welds according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
    - a. Liquid Penetrant Inspection: ASTM E 165.
    - b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
    - c. Ultrasonic Inspection: ASTM E 164.
    - d. Radiographic Inspection: ASTM E 94.

- E. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
  - 1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
  - 2. Conduct tests according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

### 3.6 REPAIRS AND PROTECTION

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

END OF SECTION 05 1200



## SECTION 05 4000 - COLD FORMED METAL FRAMING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Cold Formed Metal Framing System: The cold formed metal framing system is all of the lightgage framing work required for the construction of a complete and stable system, and includes framing members, reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connections, mechanical anchorages to adjoining work, and fabrication and erection instructions.
- B. Section Includes:
  - 1. Exterior and interior non-load-bearing wall framing.
  - 2. Interior soffit framing.
  - 3. Other framing specifically noted on the Contract Drawings as Lightgage.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of cold-formed steel framing product and accessory.
- B. Shop Drawings:
  - 1. Submit an erection plan, framing elevations, sections and details as required to include all of the information required to construct the cold formed metal framing system.
  - 2. Include the layout, spacing, size, thickness, and types of cold-formed steel framing members.
  - 3. Include reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connections, and mechanical anchorages to adjoining work.
  - 4. Fabrication and erection details.

#### 1.4 INFORMATIONAL SUBMITTALS, IF SPECIFICALLY REQUESTED

- A. Qualification Data: For testing agency.
- B. Welding certificates.

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

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage a company specializing and who has a minimum of five years continuous experience in the installation of cold-formed metal framing similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Manufacturer Qualifications: Engage a company specializing and who has a minimum of five years continuous experience in the fabrication of cold-formed metal framing similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- C. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- D. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- E. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
- F. Field Inspections and Testing as specified in the Field Quality Control paragraph will be provided by the owner. Cooperate with the Inspector. The Contractor shall provide the Inspector sufficient notification to allow the required inspections to be made without delaying the construction schedule. The Contractor shall confirm that ALL inspections have been completed and approved by the Inspector prior to proceeding with Work.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling. Protect with a waterproof covering and ventilate to avoid condensation.

## PART 2 - PRODUCTS

### 2.1 COLD-FORMED STEEL FRAMING, GENERAL

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
  - 1. Grade: As required by structural performance; Minimum yield strength of 33 ksi.
  - 2. Coating: G60.
- B. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
  - 1. Grade: As required by structural performance; Minimum yield strength of 33 ksi.
  - 2. Coating: G60.

### 2.2 EXTERIOR WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
  - 1. Minimum Base-Metal Thickness: 0.0329 inch.
  - 2. Minimum Flange Width: 1-5/8 inches.
  - 3. Section Properties: As required by Delegated-Design.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
  - 1. Minimum Base-Metal Thickness: Matching steel studs.
  - 2. Flange Width: 1-1/4 inches.
  - 3. Section Properties: As required by Delegated-Design.
- C. Framing around Openings:
  - 1. Minimum Base-Metal Thickness: 0.0566 inch (16ga) at the face of the opening where infill work, such as doors, windows, storefronts, and louvers are attached to the face of the opening.
  - 2. Use built-up framing where required.
- D. Vertical Deflection Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web as required by Delegated-Design requirements.
- E. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
  - 1. Minimum Base-Metal Thickness: 0.0428 inch.

2. Flange Width: 1 inch plus the design gap for one-story structures.
  3. Section Properties: As required by Delegated-Design.
- F. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
    - a. Minimum Base-Metal Thickness: 0.0428 inch
    - b. Flange Width: 1 inch plus the design vertical displacement of the primary building structure.
    - c. Section Properties: As required by Delegated-Design.
  2. Inner Track: Of web depth indicated, and as follows:
    - a. Minimum Base-Metal Thickness: Matching steel studs.
    - b. Flange Width: 1-1/4 inches.

## 2.3 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
1. Supplementary framing.
  2. Bracing, bridging, and solid blocking.
  3. Web stiffeners.
  4. Anchor clips.
  5. End clips.
  6. Foundation clips.
  7. Gusset plates.
  8. Stud kickers and knee braces.
  9. Joist hangers and end closures.
  10. Hole reinforcing plates.
  11. Backer plates.

## 2.4 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C or mechanically deposition according to ASTM B 695, Class 50.

- C. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.
- D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
- E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
  - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- F. Welding Electrodes: Comply with AWS standards.

## 2.5 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A 780.
- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30-minute working time.
- D. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.
- E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.
- F. All other materials not specifically described but required for a complete and proper installation as indicated on the Drawings shall be new, suitable for intended use, first quality of their respective kinds, and subject to the approval of the Architect.

## 2.6 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
  - 1. Fabricate framing assemblies using jigs or templates.
  - 2. Cut framing members by sawing or shearing; do not torch cut.

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

## PART 3 - EXECUTION

### 3.1 EXAMINATION

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

### 3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

- C. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

### 3.3 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200 and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
  - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
  - 1. Cut framing members by sawing or shearing; do not torch cut.
  - 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
    - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    - b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 07 2100 "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

- J. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
  - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

### 3.4 WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
  - 1. Stud Spacing: As required by Delegated-Design; 24 inches.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
  - 1. Install single deep-leg deflection tracks and anchor to building structure.
  - 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
  - 3. Connect vertical deflection clips to bypassing or infill studs and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
  - 1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
    - a. Install solid blocking at centers indicated on Shop Drawings.
  - 2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
  - 3. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
  - 4. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.



- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.
- G. Vertical control joints shall separate framing supported from the roof structure from framing supported from the foundation. The control joint shall accommodate vertical relative movement of the framing on each side of the joint.

### 3.5 FIELD QUALITY CONTROL

- A. Inspection and Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare reports. The following items will be inspected and tested:
  - 1. Mechanical Connections: The size, spacing, and installation shall be periodically inspected.
  - 2. Welded Connections: Field and shop welds will be periodically visually inspected. If the field weld does not pass visual inspection, the weld shall be repaired or additional testing and inspection may be required.
- B. Inspection and Testing agency will report test results promptly and in writing to Contractor and Architect.
- C. Remove and replace work where test results indicate that it does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### 3.6 REPAIRS AND PROTECTION

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

END OF SECTION 05 4000

## SECTION 05 5000 - METAL FABRICATIONS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Steel framing and supports for countertops.
  - 2. Steel framing and supports for mechanical and electrical equipment.
  - 3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
  - 4. Elevator machine beams, hoist beams,.
  - 5. Steel shapes for supporting elevator door sills.
  - 6. Metal ladders.
  - 7. Metal bollards.
- B. Products furnished, but not installed, under this Section include the following:
  - 1. Loose steel lintels.
  - 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 03 3000 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts, and other items cast into concrete.
  - 2. Section 04 2000 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
  - 3. Section 05 1200 "Structural Steel Framing."

#### 1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

#### 1.4 ACTION SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
  - 1. Steel framing and supports for countertops.
  - 2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
  - 3. Metal ladders.

#### 1.5 INFORMATIONAL SUBMITTALS

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

#### 1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
  - 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

#### 1.7 FIELD CONDITIONS

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

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. 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.

## 2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Stainless-Steel Sheet, Strip, and Plate: ASTM A 240/A 240M or ASTM A 666, Type 304.
- D. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- E. 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.
- F. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- G. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.
- H. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.

## 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.
- 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. 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.
- D. 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.
- E. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.

- F. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- G. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
  - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, 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.

## 2.4 MISCELLANEOUS MATERIALS

- A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
  - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- B. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- C. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- D. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- E. Concrete: Comply with requirements in Section 03 3000 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

## 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.
- 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

- 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. Furnish inserts for units installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.
- D. Prime miscellaneous framing and supports with zinc-rich primer where indicated.

## 2.7 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch 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 METAL LADDERS

- A. General:
  1. Comply with ANSI A14.3.
  2. For elevator pit ladders, comply with ASME A17.1/CSA B44.
- B. Steel Ladders:
  1. Space siderails 18 inches apart unless otherwise indicated.
  2. Siderails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges.
  3. Rungs: 1-inch- diameter steel bars.
  4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
  5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
  6. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung.
    - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) Harsco Industrial IKG, a division of Harsco Corporation.
      - 2) SlipNOT Metal Safety Flooring; W.S. Molnar Company.
  7. Provide platforms as indicated fabricated from welded or pressure-locked steel bar grating, supported by steel angles. Limit openings in gratings to no more than 1/2 inch in least dimension.
  8. Galvanize exterior ladders, including brackets.

## 2.9 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
  1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

- C. Galvanize and prime exterior miscellaneous steel trim.

#### 2.10 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 40 steel pipe 1/4-inch wall-thickness rectangular steel tubing.
  - 1. Where bollards are indicated to receive light fixtures, provide cutouts for fixtures and holes for wire.
- B. Fabricate bollards with 3/8-inch- thick steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for 3/4-inch anchor bolts.
  - 1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.
- C. Prime bollards with zinc-rich primer.

#### 2.11 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. 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.

#### 2.12 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.

#### 2.13 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.



## 2.14 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
  - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
  - 1. Shop prime with universal shop primer unless zinc-rich primer is indicated.
- C. Preparation for Shop Priming: Prepare surfaces to comply with SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  - 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."
- D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
  - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.

- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

### 3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
  1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.
- C. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
  1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

### 3.3 INSTALLING METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
- B. Anchor bollards to existing construction with expansion anchors . Provide four 3/4-inch bolts at each bollard unless otherwise indicated.
  1. Embed anchor bolts at least 4 inches in concrete.
- C. Anchor bollards in place with concrete footings. Center and align bollards in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
- D. Fill bollards solidly with concrete, mounding top surface to shed water.

### 3.4 INSTALLING BEARING AND LEVELING PLATES

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

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

END OF SECTION 05 5000

## SECTION 05 5213 - PIPE AND TUBE RAILINGS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Steel pipe railings.
- B. Related Requirements:
  - 1. Section 05 7313 "Glazed Decorative Metal Railings" for ornamental railings fabricated from pipes and tubes.

#### 1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- C. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Manufacturer's product lines of mechanically connected railings.
  - 2. Railing brackets.
  - 3. Grout, anchoring cement, and paint products.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.

- B. Evaluation Reports: For post-installed anchors, from ICC-ES.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

#### 1.7 FIELD CONDITIONS

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

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Handrails and Top Rails of Guards:
    - a. Uniform load of 50 lbf/ ft. applied in any direction.
    - b. Concentrated load of 200 lbf applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
  - 2. Infill of Guards:
    - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
    - b. Infill load and other loads need not be assumed to act concurrently.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

#### 2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
  - 1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

## 2.3 STEEL AND IRON

- A. Tubing: ASTM A 500 (cold formed) or ASTM A 513.
- B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
- C. Plates, Shapes, and Bars: ASTM A 36/A 36M.

## 2.4 FASTENERS

- A. General: Provide the following:
  - 1. Hot-Dip Galvanized Railings: Type 304 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153/A 153M or ASTM F 2329 for zinc coating.
  - 2. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated[ and capable of withstanding design loads].
- C. Fasteners for Interconnecting Railing Components:
  - 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to 6 times the load imposed when installed in unit masonry and 4 times the load imposed when installed in concrete, as determined by testing according to ASTM E 488/E 488M, conducted by a qualified independent testing agency.
  - 1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941, 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.

## 2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
  - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

- C. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- D. Intermediate Coats and Topcoats: Provide products that comply with Section 09 9113 "Exterior Painting" and Section 09 9123 "Interior Painting."
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- G. Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
  - 1. Water-Resistant Product: At exterior locations provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

## 2.6 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that are exposed to weather in a manner that excludes water. Provide weep holes where water may accumulate.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.
  3. Remove flux immediately.
  4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
- J. Form Changes in Direction as Follows:
1. As detailed.
- K. For changes in direction made by bending, use jigs to produce uniform curvature for each repetitive configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- L. Close exposed ends of railing members with prefabricated end fittings.
- M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- P. For railing posts set in concrete, provide stainless-steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.
- 2.7 STEEL AND IRON FINISHES
- A. Galvanized Railings:
1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
  2. Comply with ASTM A 123/A 123M for hot-dip galvanized railings.
  3. Comply with ASTM A 153/A 153M for hot-dip galvanized hardware.
  4. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.



5. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
  - B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
  - C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
  - D. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, galvanize anchors to be embedded in exterior concrete or masonry.
  - E. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
  - F. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
1. Shop prime uncoated railings with universal shop primer unless indicated.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

#### 3.2 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
  1. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
  2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
  3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
  1. Coat, with a heavy coat of bituminous paint, concealed surfaces of aluminum that are in contact with grout, concrete, masonry, wood, or dissimilar metals.

- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

### 3.3 RAILING CONNECTIONS

- A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.
- B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

### 3.4 ANCHORING POSTS

- A. Use metal sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material.

### 3.5 ATTACHING RAILINGS

- A. Attach railings to wall with wall brackets, except where end flanges are used. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- B. Secure wall brackets and railing end flanges to building construction as follows:
  - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
  - 2. For hollow masonry anchorage, use toggle bolts.
  - 3. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
  - 4. For steel-framed partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with stud installation to locate backing members.
  - 5. For steel-framed partitions, use self-tapping screws fastened to steel framing or to concealed steel reinforcements.
  - 6. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.6 ADJUSTING AND CLEANING

- A. Clean by washing thoroughly with clean water and soap and rinsing with clean water.
- B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 9113 "Exterior Painting" and Section 09 9123 "Interior Painting."
- C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A 780/A 780M.

3.7 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION 05 5213

## SECTION 05 7313 - GLAZED DECORATIVE METAL RAILINGS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 DEFINITIONS

- A. Railings: Guards, handrails, and similar devices used for protection of occupants at open-sided floor areas and for pedestrian guidance and support, visual separation, or wall protection.

#### 1.3 COORDINATION AND SCHEDULING

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible.
- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver items to Project site in time for installation.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Manufacturer's product lines of railings assembled from standard components.
  - 2. Grout, anchoring cement, and paint products.
- B. Shop Drawings: Include plans, elevations, sections, and attachment details.
- C. Samples for Verification: For each type of exposed finish required.
  - 1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
  - 2. Each type of glass required.
  - 3. Fittings and brackets.
  - 4. Assembled Samples of railing systems, made from full-size components, including top rail, post, handrail, and infill. Show method of finishing members at intersections. Samples need not be full height.

- D. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

## 1.5 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings:
  - 1. C. R. Laurence Co., Inc.
- B. Source Limitations: Obtain each type of railing from single source from single manufacturer.
- C. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods, including structural analysis, preconstruction testing, field testing, and in-service performance.
  - 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.
- D. Product Options: Drawings indicate size, profiles, and dimensional requirements of railings and are based on the specific system indicated. See Section 01 6000 "Product 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.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design railings, including attachment to building construction.

- B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
  - 1. Aluminum: The lesser of minimum yield strength divided by 1.65 or minimum ultimate tensile strength divided by 1.95.
  - 2. Steel: 72 percent of minimum yield strength.
- C. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
  - 1. Handrails and Top Rails of Guards:
    - a. Uniform load of 50 lbf/ft. applied in any direction.
    - b. Concentrated load of 200 lbf applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
  - 2. Infill of Guards:
    - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
    - b. Infill load and other loads need not be assumed to act concurrently.

## 2.3 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.

## 2.4 ALUMINUM

- A. 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.
- B. Extruded Bars and Shapes, Including Extruded Tubing: ASTM B 221, Alloy 6063-T5/T52.

## 2.5 FASTENERS

- A. Fastener Materials: Unless otherwise indicated, provide the following:
  - 1. Aluminum Components: Type 304 stainless-steel fasteners.
  - 2. Dissimilar Metals: Type 304 stainless-steel fasteners.
- B. Fasteners for Anchoring to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

- C. Provide concealed fasteners for interconnecting railing components and for attaching railings to other work unless otherwise indicated .
  - 1. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.
- D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308.
  - 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.

## 2.6 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate. Locate weep holes in inconspicuous locations.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
  - 1. Fabricate splice joints for field connection using an epoxy structural adhesive if this is manufacturer's standard splicing method.
- H. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

- I. Close exposed ends of hollow railing members with prefabricated end fittings.
- J. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work where indicated.
  - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and to prevent bracket or fitting rotation and crushing of substrate.
- K. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

## 2.7 GENERAL FINISH REQUIREMENTS

- A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. 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.
- B. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

## 2.8 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, or thicker.
- B. Color Anodic Finish: AAMA 611, AA-M12C22A32/A34, Class II, 0.010 mm or thicker.
  - 1. Color: As selected by Architect from full range of industry colors and color densities.
- C. High-Performance Organic Finish: -coat fluoropolymer finish complying with AAMA 2605 and containing not less than 50 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.



- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
  - 1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
  - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
  - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
  - 1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

### 3.2 RAILING CONNECTIONS

- A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of railings.

### 3.3 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION 05 7313

## SECTION 06 1053 - MISCELLANEOUS ROUGH CARPENTRY

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Wood blocking, cants, and nailers.
  - 2. Wood sleepers.
  - 3. Plywood backing panels.
- B. Related Requirements:
  - 1. Section 06 1600 "Sheathing" for sheathing, subflooring, and underlayment.

#### 1.3 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal or greater size but less than 5 inches nominal size in least dimension.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
  - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
  - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
  - 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.

4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

## PART 2 - PRODUCTS

### 2.1 WOOD PRODUCTS, GENERAL

- A. Maximum Moisture Content of Lumber: 15 percent unless otherwise indicated.

### 2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWPA 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. Do not use inorganic boron (SBX) for sill plates.
  2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- 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, 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 framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
  5. Wood floor plates that are installed over concrete slabs-on-grade.

## 2.3 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
  - 1. Blocking.
  - 2. Nailers.
  - 3. Furring.
- B. Dimension Lumber Items: Construction or No. 2 grade lumber of any species.
- C. 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.
- D. 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.
- E. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

## 2.4 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
  - 1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Screws for Fastening to Metal Framing: ASTM C 1002, length as recommended by screw manufacturer for material being fastened.
- D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, as appropriate for the substrate.

## 2.5 METAL FRAMING ANCHORS

- A. See structural drawings.

## 2.6 MISCELLANEOUS MATERIALS

- A. 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.
- B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

## 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 carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.
- D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- E. Do not splice structural members between supports unless otherwise indicated.
- F. 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.
- G. 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.
  - 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.

3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.

4.

- H. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- I. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
  2. ICC-ES evaluation report for fastener.
- J. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

### 3.2 WOOD BLOCKING AND NAILER INSTALLATION

- A. Install where indicated and where required for[ screeding or] attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

### 3.3 WOOD FURRING INSTALLATION

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

### 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 miscellaneous rough carpentry from weather. If, despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 1053

## SECTION 06 1600 - SHEATHING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

1. Wall sheathing.
2. Roof sheathing.
3. Subflooring.

- B. Related Requirements:

1. Section 06 1053 "Miscellaneous Rough Carpentry" for plywood backing panels.
2. Section 07 2500 "Weather Barriers" for water-resistive barrier applied over wall sheathing.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: As tested according to ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

## 2.2 WOOD PANEL PRODUCTS

- A. Certified Wood: For the following wood products, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship":
  - 1. Plywood.
  - 2. Oriented strand board.
- B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

## 2.3 WALL SHEATHING

- A. Plywood Sheathing: Exterior, Structural I Exterior sheathing.
  - 1. Nominal Thickness: Not less than 1/2 inch .
- B. Oriented-Strand-Board Sheathing: DOC PS 2, Exposure 1, Structural I sheathing.
- C. Paper-Surfaced Gypsum Sheathing: ASTM C 1396/C 1396M, gypsum sheathing; with water-resistant-treated core and with water-repellent paper bonded to core's face, back, and long edges.

## 2.4 ROOF SHEATHING

- A. Plywood Sheathing: Exterior, Structural I sheathing.
  - 1. Span Rating: Not less than 40/20.
  - 2. Nominal Thickness: Not less than 5/8" .

## 2.5 SUBFLOORING AND UNDERLAYMENT

- A. Plywood Combination Subfloor-Underlayment: DOC PS 1, Exposure 1, Underlayment single-floor panels (tongue and groove).
  - 1. Span Rating: Not less than 48/24.
  - 2. Nominal Thickness: Not less than 3/4".
- B. Plywood Subflooring: , single-floor panels or sheathing.

## 2.6 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
  - 1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.



- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Screws for Fastening Sheathing to Wood Framing: ASTM C 1002.
- D. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C 954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

## 2.7 MISCELLANEOUS MATERIALS

- A. Adhesives for Field Gluing Panels to Wood Framing: Formulation complying with ASTM D 3498 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
  - 1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
  - 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in the ICC's International Residential Code for One- and Two-Family Dwellings.
  - 3. ICC-ES evaluation report for fastener.
- D. Use common wire 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. Install fasteners without splitting wood.
- E. Coordinate sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

### 3.2 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations in APA Form No. E30, "Engineered Wood Construction Guide," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
  - 1. Subflooring:
    - a. Glue and nail to wood framing.
  - 2. Wall and Roof Sheathing:
    - a. Nail to wood framing. Apply a continuous bead of glue to framing members at edges of wall sheathing panels.
    - b. Screw to cold-formed metal framing.
    - c. Space panels 1/8 inch apart at edges and ends.
  - 3. Underlayment:
    - a. Nail or staple to subflooring.
    - b. Space panels 1/32 inch apart at edges and ends.
    - c. Fill and sand edge joints of underlayment receiving resilient flooring immediately before installing flooring.

### 3.3 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
  - 1. Fasten gypsum sheathing to cold-formed metal framing with screws.
  - 2. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
  - 3. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.
- C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent panels without forcing. Abut ends over centers of studs, and stagger end joints of adjacent panels not less than one stud spacing. Attach at perimeter and within field of panel to each stud.
  - 1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.

2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.
- D. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.
1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.
  2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.
- E. Seal sheathing joints according to sheathing manufacturer's written instructions.
1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
  2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

END OF SECTION 06 1600

## SECTION 06 41 13 - WOOD-VENEER-FACED ARCHITECTURAL CABINETS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Wood-veneer-faced architectural cabinets.
  - 2. Wood furring, blocking, shims, and hanging strips for installing architectural cabinets that are not concealed within other construction.
- B. Related Requirements:
  - 1. Section 06 1053 "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.

#### 1.3 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. Shop Drawings: For architectural cabinets.
  - 1. Include plans, elevations, sections, and attachment details.
  - 2. Show large-scale details.
  - 3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
  - 4. Show locations and sizes of cutouts and holes for items installed in architectural cabinets.

5. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.

C. Samples for Verification: For the following:

1. Lumber for Transparent Finish: Not less than 5 inches wide by 12 inches long, for each species and cut, finished on one side and one edge.
2. Veneer Leaves: Representative of and selected from flitches to be used for transparent-finished cabinets.
3. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

## PART 2 - PRODUCTS

### 2.1 CABINETS, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural cabinets indicated for construction, finishes, installation, and other requirements.
  - 1. The Contract Documents contain requirements that are more stringent than the referenced woodwork quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

### 2.2 WOOD CABINETS FOR TRANSPARENT FINISH

- A. Grade: Custom.
- B. Type of Construction: Frameless.
- C. Door and Drawer-Front Style: Flush overlay.
- D. Wood for Exposed Surfaces:
  - 1. Species: White oak.
  - 2. Cut: Rift cut/rift sawn.
  - 3. Grain Direction: As indicated on Drawings.
  - 4. Matching of Veneer Leaves: Book match.
  - 5. Veneer Matching within Panel Face: Running Center-balance match.
  - 6. Veneer Matching within Room: Provide cabinet veneers in each room or other space from a single flitch with doors, drawer fronts, and other surfaces matched in a sequenced set with continuous match where veneers are interrupted perpendicular to the grain.
- E. Semiexposed Surfaces:
  - 1. Surfaces Other Than Drawer Bodies: Same species and cut indicated for exposed surfaces.
- F. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
  - 1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.

## 2.3 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
  - 1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.
  - 2. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.

## 2.4 CABINET HARDWARE AND ACCESSORIES

- A. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening, self-closing.
- B. Back-Mounted Pulls: BHMA A156.9, B02011.
- C. Shelf Rests: BHMA A156.9, B04013; metal.
- D. Drawer Slides: BHMA A156.9.
  - 1. Grade 1 and Grade 2: Side mounted and extending under bottom edge of drawer.
    - a. Material: Epoxy-coated steel with polymer rollers.
  - 2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full -extension type; zinc-plated-steel, ball-bearing slides.
  - 3. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 1.
  - 4. For drawers more than 3 inches high, but not more than 6 inches high and not more than 24 inches wide, provide Grade 1HD-100.
  - 5. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-200.
  - 6. For computer keyboard shelves, provide Grade 1HD-100.
  - 7. For trash bins not more than 20 inches high and 16 inches wide, provide Grade 1HD-200.
- E. Door Locks: BHMA A156.11, E07121.
- F. Drawer Locks: BHMA A156.11, E07041.
- G. Door and Drawer Silencers: BHMA A156.16, L03011.

- H. Grommets for Cable Passage: 2-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage.
  - 1. Color: As approved by Architect.
- I. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
  - 1. Bright Chromium Plated: BHMA 625 for brass or bronze base; BHMA 651 for steel base.
- J. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

## 2.5 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

## 2.6 FABRICATION

- A. Fabricate architectural cabinets to dimensions, profiles, and details indicated. Ease edges and corners to 1/16-inch radius unless otherwise indicated.
- B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
  - 1. Notify Architect seven days in advance of the dates and times architectural cabinet fabrication will be complete.
  - 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.



## 2.7 SHOP FINISHING

- A. General: Contractors option to field finish or to finish architectural cabinets at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
- B. General: Shop finish transparent-finished architectural cabinets at fabrication shop as specified in this Section. See Section 09 9123 "Interior Painting" for field finishing of opaque-finished architectural cabinets.
- C. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural cabinets, as applicable to each unit of work.
- D. Transparent Finish:
  - 1. Grade: Premium.
  - 2. Finish: System - 2, precatalyzed lacquer .
  - 3. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to cabinets made from closed-grain wood before staining and finishing.
  - 4. Staining: None required.
  - 5. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
  - 6. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D 523.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

### 3.2 INSTALLATION

- A. Grade: Install cabinets to comply with quality standard grade of item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.
- C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with cabinet surface.
  - 1. For shop-finished items, use filler matching finish of items being installed.

- D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.
  - 1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
  - 2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
  - 3. Maintain veneer sequence matching of cabinets with transparent finish.
  - 4. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips .
- E. Shop Finishes: Touch up finishing after installation of architectural cabinets. Fill nail holes with matching filler.
  - 1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.
- F. Field Finishing: See Section 09 9300 "Staining and Transparent Finishing" for finishing of installed architectural cabinets.

### 3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semiexposed surfaces. Touch up finishes to restore damaged or soiled areas.

END OF SECTION 06 4113

## SECTION 06 41 16 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Plastic-laminate-faced architectural cabinets.
  - 2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets that are not concealed within other construction.
- B. Related Requirements:
  - 1. Section 06 1053 "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.

#### 1.3 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. Shop Drawings: For plastic-laminate-faced architectural cabinets.
  - 1. Include plans, elevations, sections, and attachment details.
  - 2. Show large-scale details.
  - 3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
  - 4. Show locations and sizes of cutouts and holes for items installed in plastic-laminate architectural cabinets.

C. Samples for Verification: For the following:

1. Plastic Laminates: 8 by 10 inches, for each type, color, pattern, and surface finish required.
  - a. Provide one sample applied to core material with specified edge material applied to one edge.
  - b. Miter joints for standing trim.
2. Exposed Cabinet Hardware and Accessories: One full-size unit for each type and finish.

1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

- A. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.
- B. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

## PART 2 - PRODUCTS

### 2.1 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of cabinets indicated for construction, finishes, installation, and other requirements.
  - 1. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.
- B. Grade: Custom.
- C. Type of Construction: Frameless.
- D. Door and Drawer-Front Style: Flush overlay.
- E. Materials for Semiexposed Surfaces:
  - 1. All interior surfaces of cabinets are to match the exposed plastic laminate. .
- F. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
- G. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
  - 1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.
- H. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
  - 1. As indicated in the Finish Schedule .

### 2.2 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
  - 1. Wood Moisture Content: 5 to 10 percent.

### 2.3 CABINET HARDWARE AND ACCESSORIES

- A. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 135 degrees of opening, self-closing.

- B. Pulls: As indicated in Finish Schedule.
- C. Shelf Rests: BHMA A156.9, B04013; metal.
- D. Drawer Slides: BHMA A156.9.
  - 1. Grade 1 and Grade 2: Side mounted.
    - a. Type: Full extension.
    - b. Material: Epoxy-coated steel with polymer rollers.
  - 2. Grade 1HD-100 and Grade 1HD-200: Side mounted; full -extension type; zinc-plated-steel ball-bearing slides.
  - 3. For drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 1.
  - 4. For drawers more than 3 inches high, but not more than 6 inches high and not more than 24 inches wide, provide Grade 1HD-100.
  - 5. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-200.
  - 6. For computer keyboard shelves, provide Grade 1HD-100.
  - 7. For trash bins not more than 20 inches high and 16 inches wide, provide Grade 1HD-200.
- E. Door Locks: BHMA A156.11, E07121.
- F. Drawer Locks: BHMA A156.11, E07041.
- G. Door and Drawer Silencers: BHMA A156.16, L03011.
- H. Grommets for Cable Passage: 2-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage.
  - 1. Color: As selected by Architect.
- I. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
  - 1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
- J. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

## 2.4 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: [Softwood or hardwood lumber] [Fire-retardant-treated softwood lumber], kiln-dried to less than 15 percent moisture content.

- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- C. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement PVA.
  - 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

## 2.5 FABRICATION

- A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.
- B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
  - 1. Notify Architect seven days in advance of the dates and times architectural cabinet fabrication will be complete.
  - 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

### 3.2 INSTALLATION

- A. Grade: Install cabinets to comply with quality standard grade of item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.

- C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.
- D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.
  - 1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
  - 2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
  - 3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips .

### 3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION 06 4116



## SECTION 06 4600 - WOOD TRIM

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Interior standing and running trim.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
  - 1. Show details full size.
  - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
- C. Samples for Verification:
  - 1. Lumber for transparent finish, not less than 5 inches wide by 12 inches long, for each species and cut, finished on one side and one edge.
  - 2. Lumber and panel products with shop-applied opaque finish, 5 inches wide by 12 inches long for lumber and 8 by 10 inches for panels, for each finish system and color, with one-half of exposed surface finished.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver wood trim until operations that could damage wood trim have been completed in installation areas. If wood trim must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

## 1.5 FIELD CONDITIONS

- A. Weather Limitations for Exterior Work: Proceed with installation of exterior wood trim only when existing and forecasted weather conditions permit work to be performed and at least one coat of specified finish to be applied without exposure to rain, snow, or dampness.
- B. Environmental Limitations for Interior Work: Do not deliver or install interior wood trim until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- C. Environmental Limitations for Interior Work: Do not deliver or install interior wood trim until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

## 1.6 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that wood trim can be supported and installed as indicated.

## PART 2 - PRODUCTS

### 2.1 WOOD TRIM, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of wood trim indicated for construction, finishes, installation, and other requirements.
  - 1. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

### 2.2 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

- A. Grade: Premium.
- B. Wood Species and Cut: Match species and cut indicated for other types of transparent-finished architectural woodwork located in same area of building unless otherwise indicated.
  - 1. Species: See drawings.
  - 2. Cut: See Drawings.

- C. For trim items other than base wider than available lumber, use veneered construction. Do not glue for width.
  - 1. For veneered base, use hardwood lumber core, glued for width.
- D. For base wider than available lumber, glue for width. Do not use veneered construction.
- E. For rails thicker than available lumber, use veneered construction. Do not glue for thickness.

## 2.3 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of wood trim and quality grade specified unless otherwise indicated.
  - 1. Do not use plain-sawn softwood lumber with exposed, flat surfaces more than 3 inches wide.
  - 2. Wood Moisture Content for Exterior Materials: 9 to 15 percent.
  - 3. Wood Moisture Content for Interior Materials: 5 to 10 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of wood trim and quality grade specified unless otherwise indicated.
  - 1. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.

## 2.4 MISCELLANEOUS MATERIALS

- A. Interior Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln dried to less than 15 percent moisture content.
- B. Nails for Exterior Use: hot-dip galvanized or stainless steel.
- C. Screws for Exterior Use: hot-dip galvanized or stainless steel.
- D. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.
- E. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- F. Handrail Brackets: Extruded from with wall flange drilled and tapped for concealed hanger bolt and with support arm for screwing to underside of rail. Sized to provide 1-1/2-inch clearance between handrail and wall.

## 2.5 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate wood trim to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
  - 1. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
  - 2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.
- C. Backout or groove backs of flat trim members and kerf backs of other wide, flat members except for members with ends exposed in finished work.
- D. Assemble casings in shop except where shipping limitations require field assembly.
- E. Assemble moldings in shop to maximum extent possible. Miter corners in shop and prepare for field assembly with bolted fittings designed to pull connections together.

## PART 3 - EXECUTION

### 3.1 PREPARATION

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

### 3.2 INSTALLATION

- A. Grade: Install wood trim to comply with same grade as item to be installed.
- B. Assemble wood trim and complete fabrication at Project site to the extent that it was not completed in the shop.
- C. Install wood trim level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut wood trim to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor wood trim to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
  - 1. For shop-finished items, use filler matching finish of items being installed.

- F. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 36 inches long except where shorter single-length pieces are necessary.
  - 1. Fill gaps, if any, between top of base and wall with latex sealant, painted to match wall.
  - 2. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.
  - 3. Install wall railings on indicated metal brackets securely fastened to wall framing.
    - a. Space rail brackets not more than 4 ft.o.c.
- G. Refer to Section 09 9300 "Staining and Transparent Finishing" for final finishing of installed wood trim not indicated to be shop finished.

### 3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective wood trim, where possible, to eliminate functional and visual defects; where not possible to repair, replace wood trim. Adjust joinery for uniform appearance.
- B. Clean wood trim on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06 4600

## SECTION 06 6400 - PLASTIC PANELING

### 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. Plastic sheet paneling behind service sinks.
- B. Related Requirements:
  - 1. Section 06 1000 "Rough Carpentry" for wood furring for installing plastic paneling.

#### 1.3 ACTION SUBMITTALS

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

#### 1.4 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

## 2.2 PLASTIC SHEET PANELING

- A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D 5319.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Crane Composites, Inc.
    - b. Glasteel.
    - c. Marlite.
    - d. Nudo Products, Inc.
  - 2. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E 84. Identify products with appropriate markings of applicable testing agency.
    - a. Flame-Spread Index: 25 or less.
    - b. Smoke-Developed Index: 450 or less.
  - 3. Nominal Thickness: Not less than 0.09 inch.
  - 4. Surface Finish: Molded pebble texture.
  - 5. Color: White.

## 2.3 ACCESSORIES

- A. Trim Accessories: Manufacturer's standard vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.
  - 1. Color: White .
- B. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.
- C. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.
- D. Sealant: Mildew-resistant, single-component, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 07 9200 "Joint Sealants."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.
- B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.
- C. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.
- D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.
- E. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels.
  - 1. Mark plumb lines on substrate at panel joint locations for accurate installation.
  - 2. Locate trim accessories to allow clearance at panel edges according to manufacturer's written instructions.

### 3.3 INSTALLATION

- A. Install plastic paneling according to manufacturer's written instructions.
- B. Install panels in a full spread of adhesive.
- C. Install panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned.
  - 1. Drill oversized fastener holes in panels and center fasteners in holes.
  - 2. Apply sealant to fastener holes before installing fasteners.
- D. Install factory-laminated panels using concealed mounting splines in panel joints.
- E. Install trim accessories with adhesive and staples. Do not fasten through panels.



- F. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.
- G. Maintain uniform space between panels and wall fixtures. Fill space with sealant.
- H. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.
- I. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 06 6400

## SECTION 07 0150.19 - PREPARATION FOR REROOFING

### 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. Full tear-off of roof system at areas indicated on Drawings.
  - 2. Removal of flashings and counterflashings.

#### 1.3 DEFINITIONS

- A. EPS: Molded (expanded) polystyrene.
- B. Full Roof Tear-off: Removal of existing roofing system down to existing roof deck.
- C. OSB: Oriented strand board.
- D. Roofing Terminology: Definitions in ASTM D 1079 and glossary of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.

#### 1.4 PREINSTALLATION MEETINGS

- A. Preliminary Roofing Conference: Before starting removal Work, conduct conference at Project site.
  - 1. Meet with Owner, Architect, Construction Manager, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
  - 2. Review methods and procedures related to roofing tear-off, including, but not limited to, the following:
    - a. Reroofing preparation, including roofing system manufacturer's written instructions.
    - b. Temporary protection requirements for existing roofing system components that are to remain.
    - c. Existing roof drains and roof drainage during each stage of reroofing, and roof-drain plugging and plug removal.
    - d. Construction schedule and availability of materials, Installer's personnel, equipment, and facilities needed to avoid delays.

- e. Existing roof deck conditions requiring Architect notification.
- f. Existing roof deck removal procedures and Owner notifications.
- g. Condition and acceptance of existing roof deck and base flashing substrate for reuse.
- h. Structural loading limitations of roof deck during reroofing.
- i. Base flashings, special roofing details, drainage, penetrations, equipment curbs, and condition of other construction that affect reroofing.
- j. HVAC shutdown and sealing of air intakes.
- k. Shutdown of fire-suppression, -protection, and -alarm and -detection systems.
- l. Asbestos removal and discovery of asbestos-containing materials.
- m. Governing regulations and requirements for insurance and certificates if applicable.
- n. Existing conditions that may require Architect notification before proceeding.

#### 1.5 ACTION SUBMITTALS

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

#### 1.6 FIELD CONDITIONS

- A. Existing Roofing System: Built-up asphalt roofing. General contractor to verify.
- B. Owner will not occupy portions of building immediately below reroofing area.
  - 1. Conduct reroofing so Owner's operations are not disrupted.
  - 2. Provide Owner with not less than 72 hours' written notice of activities that may affect Owner's operations.
  - 3. Coordinate work activities daily with Owner so Owner has adequate advance notice to place protective dust and water-leakage covers over sensitive equipment and furnishings, shut down HVAC and fire-alarm or -detection equipment if needed, and evacuate occupants from below work area.
  - 4. Before working over structurally impaired areas of deck, notify Owner to evacuate occupants from below affected area.
    - a. Verify that occupants below work area have been evacuated before proceeding with work over impaired deck area.
- C. Protect building to be reroofed, adjacent buildings, walkways, site improvements, exterior plantings, and landscaping from damage or soiling from reroofing operations.
- D. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.
- E. Conditions existing at time of inspection for bidding will be maintained by Owner as far as practical.
  - 1. A roof moisture survey of existing roofing system is available for Contractor's reference.

2. The results of an analysis of test cores from existing roofing system are available for Contractor's reference.
  3. Construction Drawings for existing roofing system are provided for Contractor's convenience and information, but they are not a warranty of existing conditions. They are intended to supplement rather than serve in lieu of Contractor's own investigations. Contractor is responsible for conclusions derived from existing documents.
- F. Limit construction loads on existing roof areas to remain, and existing roof areas scheduled to be reroofed, and uniformly distributed loads.
- G. Weather Limitations: Proceed with reroofing preparation only when existing and forecasted weather conditions permit Work to proceed without water entering existing roofing system or building.
1. Remove only as much roofing in one day as can be made watertight in the same day.
- H. Hazardous Materials: It is not expected that hazardous materials, such as asbestos-containing materials, will be encountered in the Work.
1. Hazardous materials will be removed by Owner before start of the Work.
  2. Existing roof will be left no less watertight than before removal.
  3. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.
    - a. Hazardous materials will be removed by Owner under a separate contract.
- I. Hazardous Materials: A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
1. Hazardous material remediation is specified elsewhere in the Contract Documents.
  2. Do not disturb hazardous materials or items suspected of containing hazardous materials except according to procedures specified elsewhere in the Contract Documents.
  3. Coordinate reroofing preparation with hazardous material remediation to prevent water from entering existing roofing system or building.

## PART 2 - PRODUCTS

### 2.1 INFILL AND REPLACEMENT MATERIALS

- A. Use infill materials matching existing roofing system materials unless otherwise indicated.
1. Infill materials are specified in Section 07 5323 "Ethylene-Propylene-Diene-Monomer (EPDM) Roofing" unless otherwise indicated.

- B. Wood blocking, curbs, and nailers are specified in Section 06 1053 Miscellaneous Rough Carpentry."

## 2.2 AUXILIARY REROOFING MATERIALS

- A. General: Use auxiliary reroofing preparation materials recommended by roofing system manufacturer for intended use and compatible with components of existing and new roofing system.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protection of In-Place Conditions:
  - 1. Loosely lay 1-inch- minimum thick, EPS insulation over existing roofing in areas not to be reroofed.
    - a. Loosely lay 15/32-inch plywood or OSB panels over EPS. Extend EPS past edges of plywood or OSB panels a minimum of 1 inch.
  - 2. Limit traffic and material storage to areas of existing roofing that have been protected.
  - 3. Maintain temporary protection and leave in place until replacement roofing has been completed. Remove temporary protection on completion of reroofing.
  - 4. Comply with requirements of existing roof system manufacturer's warranty requirements.
- B. Seal or isolate windows that may be exposed to airborne substances created in removal of existing materials.
- C. Shut off rooftop utilities and service piping before beginning the Work.
- D. Test existing roof drains to verify that they are not blocked or restricted.
  - 1. Immediately notify Architect of any blockages or restrictions.
- E. During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.

### 3.2 DECK PREPARATION

- A. Inspect deck after tear-off of roofing system.

- B. If broken or loose fasteners that secure deck panels to one another or to structure are observed, or if deck appears or feels inadequately attached, immediately notify Architect.

- 1. Do not proceed with installation until directed by Architect.

- C. If deck surface is unsuitable for receiving new roofing or if structural integrity of deck is suspect, immediately notify Architect.

- 1. Do not proceed with installation until directed by Architect.

### 3.3 INFILL MATERIALS INSTALLATION

- A. Immediately after roof tear-off, and inspection and repair, if needed, of deck, fill in tear-off areas to match existing roofing system construction.

- 1. Installation of infill materials is specified in Section 07 5323 "Ethylene-Propylene-Diene-Monomer (EPDM) Roofing."

### 3.4 BASE FLASHING REMOVAL

- A. Remove existing base flashings.

- 1. Clean substrates of contaminants, such as asphalt, sheet materials, dirt, and debris.

- B. Do not damage metal counterflashings that are to remain.

- 1. Replace metal counterflashings damaged during removal with counterflashings specified in Section 07 6200 "Sheet Metal Flashing and Trim."

- C. Inspect parapet sheathing, wood blocking, curbs, and nailers for deterioration and damage.

- 1. If parapet sheathing, wood blocking, curbs, or nailers have deteriorated, immediately notify Architect.
  - 2. If parapet framing, wood blocking, curbs, or nailers have deteriorated, immediately notify Architect.

### 3.5 DISPOSAL

- A. Collect demolished materials and place in containers.

- 1. Promptly dispose of demolished materials.
  - 2. Do not allow demolished materials to accumulate on-site.
  - 3. Storage or sale of demolished items or materials on-site is not permitted.

- B. Transport and legally dispose of demolished materials off Owner's property.

END OF SECTION 07 0150.19

## SECTION 07 1326 - SELF-ADHERING SHEET WATERPROOFING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Modified bituminous sheet waterproofing.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
  - 2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.
- B. Shop Drawings: Show locations and extent of waterproofing and details of substrate joints and cracks, expansion joints, sheet flashings, penetrations, inside and outside corners, tie-ins with adjoining waterproofing, and other termination conditions.
  - 1. Include setting drawings showing layout, sizes, sections, profiles, and joint details of pedestal-supported concrete pavers.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranties: For special warranties.

#### 1.5 FIELD CONDITIONS

- A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer. Do not apply waterproofing to a damp or wet substrate.
  - 1. Do not apply waterproofing in snow, rain, fog, or mist.
- B. Maintain adequate ventilation during preparation and application of waterproofing materials.



## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations for Waterproofing System: Obtain waterproofing materials from single source from single manufacturer.

### 2.2 MODIFIED BITUMINOUS SHEET WATERPROOFING

- A. Modified Bituminous Sheet: Minimum 60-mil nominal thickness, self-adhering sheet consisting of 56 mils of rubberized asphalt laminated on one side to a 4-mil- thick, polyethylene-film reinforcement, and with release liner on adhesive side.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. American Hydrotech, Inc.
    - b. Carlisle Coatings & Waterproofing Inc.
    - c. Henry Company.
    - d. MAPEI Corporation.
    - e. Tamko Building Products, Inc.
  - 2. Physical Properties:
    - a. Tensile Strength, Membrane: 250 psi minimum; ASTM D 412, Die C, modified.
    - b. Ultimate Elongation: 300 percent minimum; ASTM D 412, Die C, modified.
    - c. Low-Temperature Flexibility: Pass at minus 20 deg F; ASTM D 1970/D 1970M.
    - d. Crack Cycling: Unaffected after 100 cycles of 1/8-inch movement; ASTM C 836/C 836M.
    - e. Puncture Resistance: 40 lbf minimum; ASTM E 154/E 154M.
    - f. Water Absorption: 0.2 percent weight-gain maximum after 48-hour immersion at 70 deg F; ASTM D 570.
    - g. Water Vapor Permeance: 0.05 perm maximum; ASTM E 96/E 96M, Water Method.
    - h. Hydrostatic-Head Resistance: 200 feet minimum; ASTM D 5385.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of waterproofing.
  - 1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.

2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method according to ASTM D 4263.
  3. Verify that compacted subgrade is dry, smooth, sound, and ready to receive waterproofing sheet.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.
- B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.
- C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids.
- E. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks according to ASTM D 4258.
1. Install sheet strips of width according to manufacturer's written instructions and center over treated construction and contraction joints and cracks exceeding a width of .
- F. Bridge and cover isolation joints, expansion joints, and discontinuous deck-to-wall and deck-to-deck joints with overlapping sheet strips of widths according to manufacturer's written instructions.
1. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.
- G. Corners: Prepare, prime, and treat inside and outside corners according to ASTM D 6135.
1. Install membrane strips centered over vertical inside corners. Install 3/4-inch fillets of liquid membrane on horizontal inside corners and as follows:
    - a. At footing-to-wall intersections, extend liquid membrane in each direction from corner or install membrane strip centered over corner.
- H. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through waterproofing and at drains and protrusions according to ASTM D 6135.

### 3.3 MODIFIED BITUMINOUS SHEET-WATERPROOFING APPLICATION

- A. Install modified bituminous sheets according to waterproofing manufacturer's written instructions and per recommendations in ASTM D 6135.
- B. Apply primer to substrates at required rate and allow it to dry. Limit priming to areas that will be covered by sheet waterproofing in same day. Reprime areas exposed for more than 24 hours.
- C. Apply and firmly adhere sheets over area to receive waterproofing. Accurately align sheets and maintain uniform 2-1/2-inch- minimum lap widths and end laps. Overlap and seal seams, and stagger end laps to ensure watertight installation.
  - 1. When ambient and substrate temperatures range between 25 and 40 deg F, install self-adhering, modified bituminous sheets produced for low-temperature application. Do not use low-temperature sheets if ambient or substrate temperature is higher than 60 deg F.
- D. Two-Ply Application: Install sheets to form a membrane with lap widths not less than 50 percent of sheet widths, to provide a minimum of two thicknesses of sheet membrane over areas to receive waterproofing.
- E. Horizontal Application: Apply sheets from low to high points of decks to ensure that laps shed water.
- F. Apply continuous sheets over already-installed sheet strips, bridging substrate cracks, construction, and contraction joints.
- G. Seal edges of sheet-waterproofing terminations with mastic.
- H. Install sheet-waterproofing and auxiliary materials to tie into adjacent waterproofing.
- I. Repair tears, voids, and lapped seams in waterproofing not complying with requirements. Slit and flatten fishmouths and blisters. Patch with sheet waterproofing extending 6 inches beyond repaired areas in all directions.

### 3.4 PROTECTION, REPAIR, AND CLEANING

- A. Do not permit foot or vehicular traffic on unprotected membrane.
- B. Protect waterproofing from damage and wear during remainder of construction period.
- C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.
- D. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 07 1326

## SECTION 07 2100 - THERMAL INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Extruded polystyrene foam-plastic board.
  - 2. Glass-fiber blanket.
  - 3. Spray-applied cellulosic insulation.
- B. Related Requirements:
  - 1. Section 07 5323 "Ethylene-Propylene-Diene-Monomer (EPDM) Roofing" for insulation specified as part of roofing construction.
  - 2. Section 09 2900 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.

#### 1.3 ACTION SUBMITTALS

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

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
  - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
  - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
  - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

## PART 2 - PRODUCTS

### 2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD

- A. Extruded polystyrene boards in this article are also called "XPS boards." Roman numeral designators in ASTM C 578 are assigned in a fixed random sequence, and their numeric order does not reflect increasing strength or other characteristics.
- B. Extruded Polystyrene Board, Type X : ASTM C 578, Type X, 15-psi minimum compressive strength; unfaced; maximum flame-spread and smoke-developed indexes of 25 and 450, respectively, per ASTM E 84.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. DiversiFoam Products.
    - b. Dow Chemical Company (The).
    - c. Owens Corning.
  - 2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

### 2.2 GLASS-FIBER BLANKET

- A. Glass-Fiber Blanket, Unfaced : ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. CertainTeed Corporation.
    - b. Johns Manville; a Berkshire Hathaway company.
    - c. Knauf Insulation.
    - d. Owens Corning.

### 2.3 SPRAY-APPLIED CELLULOSIC INSULATION

- A. Insulation 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. Self-Supported, Spray-Applied Cellulosic Insulation : ASTM C 1149, Type I (materials applied with liquid adhesive; suitable for either exposed or enclosed applications), chemically treated for flame-resistance, processing, and handling characteristics.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Central Fiber LLC.
    - b. GreenFiber.
    - c. Hamilton Manufacturing Inc.
    - d. International Cellulose Corp.
    - e. Nu-Wool Co., Inc.

## 2.4 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
  - 1. Glass-Fiber Insulation: ASTM C 764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E 84.
  - 2. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

### 3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

### 3.3 INSTALLATION OF SLAB INSULATION

- A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
  - 1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
  - 1. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.

### 3.4 INSTALLATION OF FOUNDATION WALL INSULATION

- A. Butt panels together for tight fit.
- B. Anchor Installation: Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
  - 1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application.
  - 2. Apply insulation standoffs to each spindle to create cavity width indicated on Drawings between concrete substrate and insulation.
  - 3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation.
  - 4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.
- C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

### 3.5 INSTALLATION OF CAVITY-WALL INSULATION

- A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates.

### 3.6 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
  2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
  3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
  4. For wood-framed construction, install blankets according to ASTM C 1320.

### 3.7 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 2100



## SECTION 07 2500 - WEATHER BARRIERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Building wrap.
  - 2. Flexible flashing.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. For building wrap, include data on air and water-vapor permeance based on testing according to referenced standards.

### PART 2 - PRODUCTS

#### 2.1 WATER-RESISTIVE BARRIER

- A. Building Wrap: ASTM E 1677, Type I air barrier; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested according to ASTM E 84; UV stabilized; and acceptable to authorities having jurisdiction.
  - 1. Products: Subject to compliance with requirements, provide the following:
    - a. DuPont Building Innovations: E. I. du Pont de Nemours and Company or approved equal.
  - 2. Water-Vapor Permeance: Not less than Insert value per ASTM E 96/E 96M, Desiccant Method (Procedure A).
  - 3. Air Permeance: Not more than 0.004 cfm/sq. ft. at 0.3-inch wg when tested according to ASTM E 2178.
  - 4. Allowable UV Exposure Time: Not less than three months.
  - 5. Flame Propagation Test: Materials and construction shall be as tested according to NFPA 285.
- B. Building-Wrap Tape: Pressure-sensitive plastic tape recommended by building-wrap manufacturer for sealing joints and penetrations in building wrap.

## PART 3 - EXECUTION

### 3.1 WATER-RESISTIVE BARRIER INSTALLATION

- A. Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to framing immediately after sheathing is installed.
- B. Cover sheathing with water-resistive barrier as follows:
  - 1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
  - 2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.
- C. Building Wrap: Comply with manufacturer's written instructions and warranty requirements.
  - 1. Seal seams, edges, fasteners, and penetrations with tape.
  - 2. Extend into jambs of openings and seal corners with tape.

### 3.2 FLEXIBLE FLASHING INSTALLATION

- A. Apply flexible flashing where indicated to comply with manufacturer's written instructions.
  - 1. Prime substrates as recommended by flashing manufacturer.
  - 2. Lap seams and junctures with other materials at least 4 inches except that at flashing flanges of other construction, laps need not exceed flange width.
  - 3. Lap flashing over water-resistive barrier at bottom and sides of openings.
  - 4. Lap water-resistive barrier over flashing at heads of openings.
  - 5. After flashing has been applied, roll surfaces with a hard rubber or metal roller to ensure that flashing is completely adhered to substrates.

END OF SECTION 07 2500

## SECTION 07 4213.13 - FORMED METAL WALL PANELS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Concealed-fastener, lap-seam metal wall panels.
- B. Related Sections:
  - 1. Section 07 4293 "Soffit Panels" for metal panels used in horizontal soffit applications.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings:
  - 1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
  - 2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.
- C. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below:
  - 1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

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

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.
- E. Copper Panels: Wear gloves when handling to prevent fingerprints and soiling of surface.

1.7 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.8 COORDINATION

- A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including rupturing, cracking, or puncturing.
    - b. Deterioration of metals and other materials beyond normal weathering.
  - 2. Warranty Period: Two years from date of Substantial Completion.

- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
  - 1. Wind Loads: As indicated on Drawings.
- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 at the following test-pressure difference:
  - 1. Test-Pressure Difference: 1.57 lbf/sq. ft..
- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:
  - 1. Test-Pressure Difference: 2.86 lbf/sq. ft..
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- E. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

## 2.2 CONCEALED-FASTENER, LAP-SEAM METAL WALL PANELS

- A. General: Provide factory-formed metal panels designed to be field assembled by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.
- B. Flush-Profile, Concealed-Fastener Metal Wall Panels : Formed with vertical panel edges and a flat pan between panel edges; with flush joint between panels.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide: MBCI Designer Series Flat Panel.
  - 2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
    - a. Nominal Thickness: 0.022 inch.
    - b. Exterior Finish: Two-coat fluoropolymer.
    - c. Color: As selected by Architect from manufacturer's full range.

## 2.3 MISCELLANEOUS MATERIALS

- A. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
  - 1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
- B. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- C. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

## 2.4 FABRICATION

- A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
- C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

## 2.5 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
  - 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
  - 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
    - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

### 3.3 METAL PANEL INSTALLATION

- A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
  - 1. Shim or otherwise plumb substrates receiving metal panels.
  - 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
  - 3. Install screw fasteners in predrilled holes.
  - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
  - 5. Install flashing and trim as metal panel work proceeds.
  - 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
  - 7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
  - 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
  - 1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
  - 1. Lap ribbed or fluted sheets one full rib. Apply panels and associated items true to line for neat and weathertight enclosure.
  - 2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
  - 3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
  - 4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.



5. Flash and seal panels with weather closures at perimeter of all openings.

E. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels; and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal wall panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

### 3.4 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 4213.13

## SECTION 07 4293 - SOFFIT PANELS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes metal soffit panels.
- B. Related Sections:
  - 1. Section 07 4213.13 "Formed Metal Wall Panels" for lap-seam metal wall panels.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings:
  - 1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
  - 2. Accessories: Include details of flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches .
- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:
  - 1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranties: For special warranties.

#### 1.5 CLOSEOUT SUBMITTALS

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

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.
- E. Copper Panels: Wear gloves when handling to prevent fingerprints and soiling of surface.

1.7 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.8 COORDINATION

- A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including rupturing, cracking, or puncturing.
    - b. Deterioration of metals and other materials beyond normal weathering.
  - 2. Warranty Period: Two years from date of Substantial Completion.

- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:
  - 1. Wind Loads: As indicated on Drawings.
  - 2. Other Design Loads: As indicated on Drawings.
  - 3. Deflection Limits: For wind loads, no greater than 1/180 of the span.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

### 2.2 METAL SOFFIT PANELS

- A. General: Provide metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.
- B. Flush-Profile Metal Soffit Panels : Solid panels formed with vertical panel edges and between panel edges; with flush joint between panels.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide: MBCI Artisan Series panels.

2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.
  - a. Nominal Thickness: 0.022 inch .
  - b. Exterior Finish: Two-coat fluoropolymer.
  - c. Color: Coal Black.

## 2.3 MISCELLANEOUS MATERIALS

- A. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
- B. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Finish flashing and trim with same finish system as adjacent metal panels.
- C. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
  1. Examine framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal panel manufacturer.
  2. Examine sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal panel manufacturer.
    - a. Verify that air- or water-resistive barriers been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.
  - 1. Soffit Framing: Wire tie or clip furring channels to supports, as required to comply with requirements for assemblies indicated.

### 3.3 METAL PANEL INSTALLATION

- A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
  - 1. Shim or otherwise plumb substrates receiving metal panels.
  - 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
  - 3. Install screw fasteners in predrilled holes.
  - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
  - 5. Install flashing and trim as metal panel work proceeds.
  - 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
  - 7. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
  - 1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.
  - 1. Apply panels and associated items true to line for neat and weathertight enclosure.
  - 2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
  - 3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
  - 4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.

E. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommended by manufacturer on side laps of nesting-type panels and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling, and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

### 3.4 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.
- B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 4293

## SECTION 07 5323 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

### 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. Mechanically fastened, ethylene-propylene-diene-terpolymer (EPDM) roofing system.
  - 2. Vapor retarder.
  - 3. Roof insulation.
  - 4. Cover board.
  - 5. Walkways.
- B. Section includes installation of sound-absorbing insulation strips in ribs of roof deck. Sound-absorbing insulation strips are furnished under Section 05 3100 "Steel Decking."
- C. Related Requirements:
  - 1. Section 06 1053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking and for wood-based, structural-use roof deck panels.
  - 2. Section 07 6200 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.

#### 1.3 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D 1079 and glossary of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.

#### 1.4 PREINSTALLATION MEETINGS

- A. Preliminary Roofing Conference: Before starting roof deck construction, conduct conference at [Project site] <Insert location>.
- B. Preinstallation Roofing Conference: Conduct conference at Project site.
  - 1. Meet with Owner, Architect, Construction Manager, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.



2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.
7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  1. For insulation and roof system component fasteners, include copy of FM Approvals' RoofNav listing.
- B. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:
  1. Layout and thickness if insulation.
  2. Base flashings and membrane terminations.
  3. Flashing details at penetrations.
  4. Tapered insulation, thickness, and slopes.
  5. Roof plan showing orientation of steel roof deck and orientation of roof membrane and fastening spacings and patterns for mechanically fastened roofing system.
  6. Tie-in with air barrier.
- C. Samples for Verification: For the following products:
  1. Roof membrane and flashings of color required.
  2. Walkway pads or rolls, of color required.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Manufacturer Certificates:
  1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.
    - a. Submit evidence of complying with performance requirements.

2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.

- C. Product Test Reports: For components of roof membrane and insulation, for tests performed by a qualified testing agency, indicating compliance with specified requirements.

#### 1.7 CLOSEOUT SUBMITTALS

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

#### 1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is for roofing system identical to that used for this Project.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
  1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

#### 1.10 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
  - 1. Special warranty includes roof membrane, base flashings, roof insulation, fasteners, cover boards, and other components of roofing system.
  - 2. Warranty Period: 20 years from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ETHYLENE-PROPYLENE-DIENE-TERPOLYMER (EPDM) ROOFING

- A. EPDM Sheet: ASTM D 4637/D 4637M, Type II, scrim or fabric internally reinforced, EPDM sheet with factory-applied seam tape.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Carlisle SynTec Incorporated.
    - b. Firestone Building Products.
    - c. Johns Manville; a Berkshire Hathaway company.
    - d. Mule-Hide Products Co., Inc.
    - e. Versico Incorporated.
  - 2. Thickness: 60 mils, nominal.
  - 3. Exposed Face Color: Black.
  - 4. Source Limitations: Obtain components for roofing system from roof membrane manufacturer or manufacturers approved by roof membrane manufacturer.

2.2 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.
  - 1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.
  - 2. Adhesives and sealants shall comply with the following limits for VOC content:
    - a. Plastic Foam Adhesives: 50 g/L.
    - b. Gypsum Board and Panel Adhesives: 50 g/L.
    - c. Multipurpose Construction Adhesives: 70 g/L.
    - d. Fiberglass Adhesives: 80 g/L.
    - e. Contact Adhesives: 80 g/L.
    - f. PVC Welding Compounds: 510 g/L.
    - g. Other Adhesives: 250 g/L.
    - h. Single-Ply Roof Membrane Sealants: 450 g/L.

- i. Nonmembrane Roof Sealants: 300 g/L.
    - j. Sealant Primers for Nonporous Substrates: 250 g/L.
    - k. Sealant Primers for Porous Substrates: 775 g/L.
  - B. Sheet Flashing: 60-mil- thick EPDM, partially cured or cured, according to application.
  - C. Vented Base Sheet: ASTM D 4897/D 4897M, Type II; nonperforated, asphalt-impregnated fiberglass reinforced, with mineral granular patterned surfacing on bottom surface.
  - D. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.
  - E. Roof Vents: As recommended by roof membrane manufacturer.
    - 1. Size: Not less than 4-inch diameter.
  - F. Bonding Adhesive: Manufacturer's standard, water based.
  - G. Seaming Material: Factory-applied seam tape, width as recommended by manufacturer.
  - H. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.
  - I. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.
  - J. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening components to substrate, and acceptable to roofing system manufacturer.
  - K. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, molded pipe boot flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.
- 2.3 VAPOR RETARDER
- A. Polyethylene Film: ASTM D 4397, 6 mils thick, minimum, with maximum permeance rating of 0.13 perm.
    - 1. Tape: Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.
    - 2. Adhesive: Manufacturer's standard lap adhesive, listed by FM Approvals for vapor retarder application.
- 2.4 ROOF INSULATION
- A. General: Preformed roof insulation boards manufactured or approved by EPDM roof membrane manufacturer.

- B. Extruded-Polystyrene Board Insulation: ASTM C 578, Type IV, 1.45-lb/cu. ft. minimum density, 25-psi minimum compressive strength square edged.
- C. Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Carlisle SynTec Incorporated.
    - b. Firestone Building Products.
    - c. GAF Materials Corporation.
    - d. Johns Manville; a Berkshire Hathaway company.
  - 2. Compressive Strength: 20 psi.
  - 3. Size: 48 by 96 inches.
- D. Cellular Glass Board Insulation: ASTM C 552, Type IV, rigid, cellular glass thermal board insulation faced with manufacturer's standard kraft-paper sheets.

## 2.5 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.
- B. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
  - 1. Adhesives and sealants shall comply with the following limits for VOC content:
    - a. Plastic Foam Adhesives: 50 g/L.
    - b. Gypsum Board and Panel Adhesives: 50 g/L.
    - c. Multipurpose Construction Adhesives: 70 g/L.
    - d. Fiberglass Adhesives: 80 g/L.
    - e. Contact Adhesives: 80 g/L.
    - f. PVC Welding Compounds: 510 g/L.
    - g. Other Adhesives: 250 g/L.
    - h. Single-Ply Roof Membrane Sealants: 450 g/L.
    - i. Nonmembrane Roof Sealants: 300 g/L.
    - j. Sealant Primers for Nonporous Substrates: 250 g/L.
    - k. Sealant Primers for Porous Substrates: 775 g/L.
  - 2. Adhesives and sealants 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. Cover Board: ASTM C 1177/C 1177M, glass-mat, water-resistant gypsum substrate, or ASTM C 1278/C 1278M, fiber-reinforced gypsum board.

- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. CertainTeed Corporation; GlasRoc Roof Board.
- b. Georgia-Pacific Building Products; Dens Deck.
- c. National Gypsum Company; DEXcell Glass Mat Roof Board.
- d. United States Gypsum Company; Securock Glass Mat Roof Board.

## 2.6 WALKWAYS

- A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway rolls, approximately 3/16 inch thick and acceptable to roofing system manufacturer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
  - 1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
  - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation according to roofing system manufacturer's written instructions. Remove sharp projections.
- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

### 3.3 ROOFING INSTALLATION, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions, FM Approvals' RoofNav assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.

- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

### 3.4 VAPOR RETARDER INSTALLATION

- A. Polyethylene Film: Loosely lay polyethylene-film vapor retarder in a single layer over area to receive vapor retarder, side and end lapping each sheet a minimum of 2 and 6 inches, respectively.
  - 1. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
  - 2. Continuously seal side and end laps with adhesive.
- B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

### 3.5 INSULATION INSTALLATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.
- B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.
  - a. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
  - b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
  - c. Make joints between adjacent insulation boards not more than 1/4 inch in width.
  - d. Fill gaps exceeding 1/4 inch with insulation.
  - e. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
  - f. Mechanically attach base layer of insulation using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.
    - 1) Fasten insulation according to requirements in FM Approvals' RoofNav for specified Windstorm Resistance Classification.
    - 2) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.
  - g. Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent rows.
  - h. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.

- i. Make joints between adjacent insulation boards not more than 1/4 inch in width.
- j. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.
- k. Trim insulation so that water flow is unrestricted.
- l. Fill gaps exceeding 1/4 inch with insulation.
- m. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.

C. Installation Over Wood Decking:

- 1. Mechanically fasten slip sheet to roof deck using mechanical fasteners specifically designed and sized for fastening slip sheet to wood decks.
- 2. Install base layer of insulation with joints staggered not less than 24 inches in adjacent rows.
  - a. When installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
  - b. Fill gaps exceeding 1/4 inch with insulation.
- 3. Install upper layers of insulation[ and tapered insulation] with joints of each layer offset not less than 12 inches from previous layer of insulation.

3.6 INSTALLATION OF COVER BOARDS

- A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.
  - 1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
  - 2. At internal roof drains, conform to slope of drain sump.
    - a. Trim cover board so that water flow is unrestricted.
  - 3. Cut and fit cover board tight to nailers, projections, and penetrations.
  - 4. Adhere cover board to substrate using adhesive according to FM Approvals' RoofNav assembly requirements and FM Global Property Loss Prevention Data Sheet 1-29 for specified Windstorm Resistance Classification, as follows:
    - a. Set cover board in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.
- B. Install slip sheet over cover board and immediately beneath roofing.

3.8 BASE FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.



- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.
- D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

### 3.9 WALKWAY INSTALLATION

- A. Flexible Walkways: Install walkway products according to manufacturer's written instructions.
  - 1. Install flexible walkways at the following locations:
    - a. Perimeter of each rooftop unit.
    - b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
    - c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
    - d. Top and bottom of each roof access ladder.
    - e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
    - f. Locations indicated on Drawings.
    - g. As required by roof membrane manufacturer's warranty requirements.
  - 2. Provide 6-inch clearance between adjoining pads.
  - 3. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

### 3.10 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

END OF SECTION 07 5323

## SECTION 07 6200 - SHEET METAL FLASHING AND TRIM

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Formed roof-drainage sheet metal fabrications.
  - 2. Formed low-slope roof sheet metal fabrications.
  - 3. Formed wall sheet metal fabrications.

- B. Related Requirements:

- 1. Section 06 1053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.

#### 1.3 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

#### 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and trim.
  - 3. Review requirements for insurance and certificates if applicable.
  - 4. Review sheet metal flashing observation and repair procedures after flashing installation.

## 1.5 ACTION SUBMITTALS

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

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each manufactured product and accessory.

### B. Shop Drawings: For sheet metal flashing and trim.

1. Include plans, elevations, sections, and attachment details.
2. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled work.
3. Include identification of material, thickness, weight, and finish for each item and location in Project.
4. Include details for forming, including profiles, shapes, seams, and dimensions.
5. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Include details of termination points and assemblies.
7. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Include details of roof-penetration flashing.
9. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, and counterflashings as applicable.
10. Include details of special conditions.
11. Include details of connections to adjoining work.
12. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.

### C. Samples for Verification: For each type of exposed finish.

1. Sheet Metal Flashing: 12 inches long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches long and in required profile. Include fasteners and other exposed accessories.
3. Unit-Type Accessories and Miscellaneous Materials: Full-size Sample.
4. Anodized Aluminum Samples: Samples to show full range to be expected for each color required.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- ### A.
- Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage. Store sheet metal flashing and trim materials away from uncured concrete and masonry.

- B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

## 1.7 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

- 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

- 2. Finish Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. General: Sheet metal flashing and trim assemblies shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. FM Approvals Listing: Manufacture and install copings roof edge flashings that are listed in FM Approvals' "RoofNav" and approved for windstorm classification, Class 1-90. Identify materials with name of fabricator and design approved by FM Approvals.
- D. SPRI Wind Design Standard: Manufacture and install [copings] [roof edge flashings] tested according to SPRI ES-1 and capable of resisting the following design pressure:
  - 1. Design Pressure: As indicated on Drawings.
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

## 2.2 SHEET METALS

- A. General: Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Metallic-Coated Steel Sheet: Provide zinc-coated (galvanized) steel sheet according to ASTM A 653/A 653M, G90 coating designation; prepainted by coil-coating process to comply with ASTM A 755/A 755M.
  - 1. Surface: Smooth, flat.
  - 2. Exposed Coil-Coated Finish:
    - a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 3. Color: As selected by Architect from manufacturer's full range.

## 2.3 UNDERLAYMENT MATERIALS

- A. Contractor option to use of the following:
- B. Felt: ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.
- C. Synthetic Underlayment: Laminated or reinforced, woven polyethylene or polypropylene, synthetic roofing underlayment; bitumen free; slip resistant; suitable for high temperatures over 220 deg F; and complying with physical requirements of ASTM D 226/D 226M for Type I and Type II felts.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Atlas Roofing Corporation; Summit.
    - b. Engineered Coated Products; Nova-Seal II.
    - c. Kirsch Building Products, LLC; Sharkskin Comp.
    - d. SDP Advanced Polymer Products Inc; Palisade.
- D. Self-Adhering, High-Temperature Sheet: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer according to written recommendations of underlayment manufacturer.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Carlisle Coatings & Waterproofing Inc; CCW WIP 300HT.

- b. Grace Construction Products; W.R. Grace & Co. -- Conn.; Grace Ice and Water Shield HT.
- c. Henry Company; Blueskin PE200 HT.
- d. Owens Corning; WeatherLock Metal High Temperature Underlayment.

## 2.4 MISCELLANEOUS MATERIALS

- A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
  - 1. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
    - a. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
    - b. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
    - c. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
  - 2. Fasteners for Zinc-Coated (Galvanized) Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.
- C. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- D. Elastomeric Sealant: ASTM C 920, elastomeric polyurethane polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.
- E. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement.
- F. Bituminous Coating: Cold-applied asphalt emulsion according to ASTM D 1187.
- G. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

## 2.5 FABRICATION, GENERAL

- A. General: Custom fabricate sheet metal flashing and trim to comply with details shown and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
  - 1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
  - 2. Obtain field measurements for accurate fit before shop fabrication.
  - 3. Form sheet metal flashing and trim to fit substrates without excessive oil canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
  - 4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.
- B. Fabrication Tolerances: Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
  - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
  - 2. Use lapped expansion joints only where indicated on Drawings.
- D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal to provide for proper installation of elastomeric sealant according to cited sheet metal standard.
- E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
- F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.
- G. Seams: Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- H. Seams: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
- I. Do not use graphite pencils to mark metal surfaces.

## 2.6 ROOF-DRAINAGE SHEET METAL FABRICATIONS

- A. Downspouts: Fabricate rectangular downspouts to dimensions indicated, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors.
  - 1. Fabricate from the following materials:
    - a. Galvanized Steel: 0.022 inch thick.
- B. Roof and Roof-to-Wall Transition Expansion-Joint Cover: Fabricate from the following materials: Shop fabricate interior and exterior corners.
  - 1. Galvanized Steel: 0.034 inch thick.
- C. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
  - 1. Galvanized Steel: 0.028 inch thick.
- D. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
  - 1. Galvanized Steel: 0.022 inch thick.
- E. Flashing Receivers: Fabricate from the following materials:
  - 1. Galvanized Steel: 0.022 inch thick.
- F. Roof-Penetration Flashing: Fabricate from the following materials:
  - 1. Galvanized Steel: 0.028 inch thick.

## 2.7 WALL SHEET METAL FABRICATIONS

- A. Opening Flashings in Frame Construction: Fabricate head, sill, jamb, and similar flashings to extend 4 inches beyond wall openings. Form head and sill flashing with 2-inch-high, end dams. Fabricate from the following materials:
  - 1. Aluminum-Zinc Alloy-Coated Steel: 0.022 inch thick.

## 2.8 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Equipment Support Flashing: Fabricate from the following materials:
  - 1. Galvanized Steel: 0.028 inch thick.



## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
  - 1. Verify compliance with requirements for installation tolerances of substrates.
  - 2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
  - 3. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 UNDERLAYMENT INSTALLATION

- A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim. Apply in shingle fashion to shed water, with lapped joints of not less than 2 inches .
- B. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, according to manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.
- C. Self-Adhering Sheet Underlayment: Install self-adhering sheet underlayment, wrinkle free. Prime substrate if recommended by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches . Roll laps and edges with roller. Cover underlayment within 14 days.

### 3.3 INSTALLATION, GENERAL

- A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
  - 1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.
  - 2. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

3. Space cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
  4. Install exposed sheet metal flashing and trim with limited oil canning, and free of buckling and tool marks.
  5. Torch cutting of sheet metal flashing and trim is not permitted.
  6. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.
1. Coat concealed side of uncoated-aluminum sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
  2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
- D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws .
- E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
- F. Seal joints as required for watertight construction.
1. Use sealant-filled joints unless otherwise indicated. Embed hooked flanges of joint members not less than 1 inch into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
  2. Prepare joints and apply sealants to comply with requirements in Section 07 9200 "Joint Sealants."
- G. Rivets: Rivet joints in zinc where necessary for strength.
- 3.4 ROOF-DRAINAGE SYSTEM INSTALLATION
- A. General: Install sheet metal roof-drainage items to produce complete roof-drainage system according to cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.

- B. Hanging Gutters: Join sections with joints sealed with sealant. Provide for thermal expansion. Attach gutters at eave or fascia to firmly anchor them in position. Provide end closures and seal watertight with sealant. Slope to downspouts.
  - 1. Fasten gutter spacers to front and back of gutter.
  - 2. Anchor and loosely lock back edge of gutter to continuous cleat.
  - 3. Anchor back of gutter that extends onto roof deck with cleats spaced not more than 24 inches apart.
  - 4. Anchor gutter with gutter brackets spaced not more than 24 inches apart to roof deck, unless otherwise indicated, and loosely lock to front gutter bead.
- C. Downspouts: Join sections with 1-1/2-inch telescoping joints.
  - 1. Provide elbows at base of downspout to direct water away from building.
- D. Splash Pans: Install where downspouts discharge on low-slope roofs. Set in asphalt roofing cement or elastomeric sealant compatible with the substrate.
- E. Parapet Scuppers: Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.

### 3.5 ROOF FLASHING INSTALLATION

- A. General: Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard. Provide concealed fasteners where possible, and set units true to line, levels, and slopes. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
- C. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.
- D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless-steel draw band and tighten.

### 3.6 WALL FLASHING INSTALLATION

- A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

3.7 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
- B. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerances specified in MCA's "Guide Specification for Residential Metal Roofing."

3.8 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder.
- C. Clean off excess sealants.
- D. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended by sheet metal flashing and trim manufacturer. Maintain sheet metal flashing and trim in clean condition during construction.
- E. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 6200

## SECTION 07 7100 - ROOF 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. Section Includes:
  - 1. Copings.
  - 2. Roof-edge drainage systems.
- B. Related Requirements:
  - 1. Section 06 1053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking.
  - 2. Section 07 6200 "Sheet Metal Flashing and Trim" for custom- and site-fabricated sheet metal flashing and trim.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Do not store roof specialties in contact with other materials that might cause staining, denting, or other surface damage. Store roof specialties away from uncured concrete and masonry.
- B. Protect strippable protective covering on roof specialties from exposure to sunlight and high humidity, except to extent necessary for the period of roof-specialty installation.

#### 1.5 FIELD CONDITIONS

- A. Field Measurements: Verify profiles and tolerances of roof-specialty substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.

- B. Coordination: Coordinate roof specialties with flashing, trim, and construction of parapets, roof deck, roof and wall panels, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

## 1.6 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer agrees to repair finish or replace roof specialties that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 COPINGS

- A. Metal Copings: Manufactured coping system consisting of metal coping cap in section lengths not exceeding 12 feet, concealed anchorage; with corner units, end cap units, and concealed splice plates with finish matching coping caps.
  - 1. Metallic-Coated Steel Sheet Coping Caps: Zinc-coated (galvanized) steel, nominal 0.028-inch thickness.
    - a. Surface: Smooth, flat finish.
    - b. Finish: Two-coat fluoropolymer.
    - c. Color: As selected by Architect from manufacturer's full range.
    - d. Color: As selected by Architect from manufacturer's full range.

### 2.2 ROOF-EDGE DRAINAGE SYSTEMS

- A. Gutters: Manufactured in uniform section lengths not exceeding , with matching corner units, ends, outlet tubes, and other accessories. Elevate back edge at least 1 inch above front edge. Furnish flat-stock gutter straps, gutter brackets, expansion joints, and expansion-joint covers fabricated from same metal as gutters.
  - 1. Zinc-Coated Steel: Nominal 0.028-inch thickness.
  - 2. Gutter Profile: See drawings.
  - 3. Corners: Factory mitered and mechanically clinched and sealed watertight.

- B. Downspouts: See drawings, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.

- 1. Zinc-Coated Steel: Nominal 0.028-inch thickness.

## 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 and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Coil-Coated Galvanized-Steel Sheet Finishes:
  - 1. High-Performance Organic Finish: Prepare, pretreat, and apply coating to exposed metal surfaces to comply with ASTM A 755/A 755M and coating and resin manufacturers' written instructions.
    - a. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Examine walls, roof edges, and parapets for suitable conditions for roof specialties.
- C. Verify that substrate is sound, dry, smooth, clean, sloped for drainage where applicable, and securely anchored.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION, GENERAL

- A. General: Install roof specialties according to manufacturer's written instructions. Anchor roof specialties securely in place, with provisions for thermal and structural movement. Use fasteners, solder, protective coatings, separators, underlayments, sealants, and other miscellaneous items as required to complete roof-specialty systems.
  - 1. Install roof specialties level, plumb, true to line and elevation; with limited oil-canning and without warping, jogs in alignment, buckling, or tool marks.
  - 2. Provide uniform, neat seams with minimum exposure of solder and sealant.

3. Install roof specialties to fit substrates and to result in weathertight performance. Verify shapes and dimensions of surfaces to be covered before manufacture.
  4. Torch cutting of roof specialties is not permitted.
  5. Do not use graphite pencils to mark metal surfaces.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
1. Coat concealed side of uncoated aluminum roof specialties with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
  2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof specialties for waterproof performance.
- C. Expansion Provisions: Allow for thermal expansion of exposed roof specialties.
1. Space movement joints at a maximum of 12 feet with no joints within 18 inches of corners or intersections unless otherwise indicated on Drawings.
  2. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way. Adjust setting proportionately for installation at higher ambient temperatures.
- D. Fastener Sizes: Use fasteners of sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.
- E. Seal concealed joints with butyl sealant as required by roofing-specialty manufacturer.
- F. Seal joints as required for weathertight construction. Place sealant to be completely concealed in joint. Do not install sealants at temperatures below 40 deg F.
- 3.3 COPING INSTALLATION
- A. Install cleats, anchor plates, and other anchoring and attachment accessories and devices with concealed fasteners.
- B. Anchor copings with manufacturer's required devices, fasteners, and fastener spacing to meet performance requirements.
1. Interlock face and back leg drip edges of snap-on coping cap into cleated anchor plates anchored to substrate at 30-inch centers .
  2. Interlock face-leg drip edge into continuous cleat anchored to substrate at 24-inch centers. Anchor back leg of coping with screw fasteners and elastomeric washers at 24-inch centers.
- 3.5 ROOF-EDGE DRAINAGE-SYSTEM INSTALLATION
- A. General: Install components to produce a complete roof-edge drainage system according to manufacturer's written instructions. Coordinate installation of roof perimeter flashing with installation of roof-edge drainage system.



- B. Gutters: Join and seal gutter lengths. Allow for thermal expansion. Attach gutters to firmly anchored gutter supports spaced not more than 24 inches apart. Attach ends with rivets and seal with sealant to make watertight. Slope to downspouts.
  - 1. Install gutter with expansion joints at locations indicated but not exceeding 50 feet apart. Install expansion-joint caps.
- C. Downspouts: Join sections with manufacturer's standard telescoping joints. Provide hangers with fasteners designed to hold downspouts securely to walls and 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c.
  - 1. Provide elbows at base of downspouts at grade to direct water away from building.

### 3.6 REGLET AND COUNTERFLASHING INSTALLATION

- A. General: Coordinate installation of reglets and counterflashings with installation of base flashings.
- B. Surface-Mounted Reglets: Install reglets to receive flashings where flashing without embedded reglets is indicated on Drawings. Install at height so that inserted counterflashings overlap 4 inches over top edge of base flashings.

### 3.7 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
- B. Clean and neutralize flux materials. Clean off excess solder and sealants.
- C. Remove temporary protective coverings and strippable films as roof specialties are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof specialties in a clean condition during construction.
- D. Replace roof specialties that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 7100

## SECTION 07 8413 - PENETRATION FIRESTOPPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Penetrations in fire-resistance-rated walls.
  - 2. Penetrations in horizontal assemblies.
  - 3. Penetrations in smoke barriers.

#### 1.3 ACTION SUBMITTALS

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

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.

- B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
  - 1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
  - 2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
    - a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
    - b. Classification markings on penetration firestopping correspond to designations listed by the following:
      - 1) UL in its "Fire Resistance Directory."

#### 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

#### 1.7 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Grace Construction Products.
  - 2. Hilti, Inc.
  - 3. Johns Manville.
  - 4. 3M Fire Protection Products.
  - 5. Tremco, Inc.; Tremco Fire Protection Systems Group.

6. USG Corporation.

2.2 PENETRATION FIRESTOPPING

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
- B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
  - 1. Fire-resistance-rated walls include fire walls smoke-barrier walls and fire partitions.
  - 2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
  - 1. Horizontal assemblies include [floors] [floor/ceiling assemblies] [and] [ceiling membranes of roof/ceiling assemblies].
  - 2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
  - 3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
- D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
  - 1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at 0.30-inch wg at both ambient and elevated temperatures.
- E. W-Rating: Provide penetration firestopping showing no evidence of water leakage when tested according to UL 1479.
- F. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- G. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.
  - 1. Permanent forming/damming/backing materials, including the following:
    - a. Slag-wool-fiber or rock-wool-fiber insulation.
    - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
    - c. Fire-rated form board.

- d. Fillers for sealants.
- 2. Temporary forming materials.
- 3. Substrate primers.
- 4. Collars.
- 5. Steel sleeves.

## 2.3 FILL MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- F. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- G. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- H. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- I. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
  - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

## 2.4 MIXING

- A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:
  - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
  - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
  - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

### 3.3 INSTALLATION

- A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.

- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
  - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.
- C. Install fill materials for firestopping by proven techniques to produce the following results:
  - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
  - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
  - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

#### 3.4 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

END OF SECTION 07 8413

## SECTION 07 8443 - JOINT FIRESTOPPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Joints in or between fire-resistance-rated constructions.
  - 2. Joints in smoke barriers.
- B. Related Requirements:
  - 1. Section 07 8413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers[ and for wall identification].
  - 2. Section 09 2216 "Non-Structural Metal Framing" for firestop tracks for metal-framed partition heads.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.
  - 1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each joint firestopping system, for tests performed by a qualified testing agency.



## 1.5 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

## 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

## 1.8 COORDINATION

- A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of joints to accommodate joint firestopping systems.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
  - 1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
  - 2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
    - a. Joint firestopping systems shall bear classification marking of a qualified testing agency.
      - 1) UL in its "Fire Resistance Directory."
      - 2) Intertek Group in its "Directory of Listed Building Products."

## 2.2 JOINT FIRESTOPPING SYSTEMS

- A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
- B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E 1966 or UL 2079.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. 3M Fire Protection Products.
    - b. A/D Fire Protection Systems Inc.
    - c. Blazeframe Industries.
    - d. Grabber Construction Products.
    - e. Hilti, Inc.
    - f. Metal-Lite.
    - g. Nelson Firestop; a brand of Emerson Industrial Automation.
    - h. NUCO Inc.
    - i. Passive Fire Protection Partners.
    - j. RectorSeal.
    - k. Roxul Inc.
    - l. Specified Technologies, Inc.
    - m. Thermafiber, Inc.; an Owens Corning company.
    - n. Tremco, Inc.
  - 2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.
- C. Joints at Exterior Curtain-Wall/Floor Intersections: Provide joint firestopping systems with rating determined per ASTM E 2307.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. 3M Fire Protection Products.
    - b. Hilti, Inc.
    - c. Industrial Insulation Group, LLC (IIG-LLC).
    - d. Nelson Firestop; a brand of Emerson Industrial Automation.
    - e. NUCO Inc.
    - f. RectorSeal.
    - g. Roxul Inc.
    - h. Specified Technologies, Inc.
    - i. Thermafiber, Inc.; an Owens Corning company.
    - j. Tremco, Inc.

2. F-Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.
- D. Joints in Smoke Barriers: Provide fire-resistive joint systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg .
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. 3M Fire Protection Products.
    - b. A/D Fire Protection Systems Inc.
    - c. Hilti, Inc.
    - d. Nelson Firestop; a brand of Emerson Industrial Automation.
    - e. NUCO Inc.
    - f. Passive Fire Protection Partners.
    - g. RectorSeal.
    - h. Roxul Inc.
    - i. Specified Technologies, Inc.
    - j. Thermafiber, Inc.; an Owens Corning company.
    - k. Tremco, Inc.
  2. L-Rating: Not exceeding 5.0 cfm/ft. of joint at both ambient and elevated temperatures.
- E. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Surface Cleaning: Before installing fire-resistive joint systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
  1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
  2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.

3. Remove laitance and form-release agents from concrete.

- B. Prime substrates where recommended in writing by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

### 3.3 INSTALLATION

- A. General: Install fire-resistive joint systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.
- C. Install elastomeric fill materials for fire-resistive joint systems by proven techniques to produce the following results:
1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
  2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
  3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

### 3.4 CLEANING AND PROTECTION

- A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.
- B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated fire-resistive joint systems immediately and install new materials to produce fire-resistive joint systems complying with specified requirements.

END OF SECTION 07 8443

## SECTION 07 9200 - JOINT SEALANTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Silicone joint sealants.
  - 2. Nonstaining silicone joint sealants.
  - 3. Urethane joint sealants.
  - 4. Mildew-resistant joint sealants.
  - 5. Latex joint sealants.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Joint-Sealant Schedule: Include the following information:
  - 1. Joint-sealant application, joint location, and designation.
  - 2. Joint-sealant manufacturer and product name.
  - 3. Joint-sealant formulation.
  - 4. Joint-sealant color.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranties: For special warranties.

#### 1.5 QUALITY ASSURANCE

- A. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

## 1.6 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
  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: 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: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
1. Warranty Period: Five years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
  2. Disintegration of joint substrates from causes exceeding design specifications.
  3. Mechanical damage caused by individuals, tools, or other outside agents.
  4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

## PART 2 - PRODUCTS

### 2.1 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

## 2.2 SILICONE JOINT SEALANTS

- A. Silicone, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Dow Corning Corporation; 791.
    - b. GE Construction Sealants; Momentive Performance Materials Inc; SCS2000 SilPruf.
    - c. May National Associates, Inc., a subsidiary of Sika Corporation U.S.; Bondaflex Sil 265 LTS.
    - d. Pecora Corporation; PCS.
    - e. Sika Corporation U.S.; [Sikasil WS-295] [Sikasil WS-295 FPS].

## 2.3 NONSTAINING SILICONE JOINT SEALANTS

- A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.
- B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. May National Associates, Inc., a subsidiary of Sika Corporation U.S.; Bondaflex Sil 290 FPS-NB.
    - b. Pecora Corporation; 890FTS/TXTR.
    - c. Tremco Incorporated; Spectrem 1.

## 2.4 URETHANE JOINT SEALANTS

- A. Urethane, S, NS, 25, NT: Single-component, nonsag, nontraffic-use, plus 25 percent and minus 25 percent movement capability, urethane joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. BASF Construction Chemicals - Building Systems; Sonalastic TX1.
    - b. Bostik, Inc.; Chem-Calk GPS1.
    - c. ER Systems, an ITW Company; Pacific Polymers Elasto-Thane 230 MP.
    - d. Pecora Corporation; Dynatrol I-XL.
    - e. Polymeric Systems, Inc.; Flexiprene 1000.

- f. Schnee-Morehead, Inc., an ITW company; Permthane SM7108.
  - g. Sherwin-Williams Company (The); Stampede-1.
  - h. Sika Corporation U.S.; Sikaflex Textured Sealant.
  - i. Tremco Incorporated; Dymonic.
- B. Urethane, S, P, 25, T, NT: Single-component, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type S, Grade P, Class 25, Uses T and NT.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. BASF Construction Chemicals - Building Systems; Sonolastic SL 1.
    - b. Pecora Corporation; NR-201.
    - c. Polymeric Systems, Inc.; Flexiprene 952.
    - d. Schnee-Morehead, Inc.; an ITW company; Permthane SM7101.
    - e. Sherwin-Williams Company (The); Stampede 1SL.
- C. Urethane, M, P, 50, T, NT: Multicomponent, pourable, plus 50 percent and minus 50 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade P, Class 50, Uses T and NT.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. LymTal International, Inc.; Iso-Flex 888QC.

## 2.5 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
  - 1. Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:
    - a. Dow Corning Corporation; 786-M White.
    - b. GE Construction Sealants; Momentive Performance Materials Inc.; SCS1700 Sanitary.
    - c. May National Associates, Inc., a subsidiary of Sika Corporation U.S.; Bondaflex Sil 100 WF.
    - d. Soudal USA; RTV GP.
    - e. Tremco Incorporated; Tremsil 200.



## 2.6 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. BASF Construction Chemicals - Building Systems.
    - b. Construction Foam Products, a division of Nomaco, Inc.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

## 2.7 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

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

### 3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
  2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
    - a. Concrete.
    - b. Masonry.
  3. Remove laitance and form-release agents from concrete.
  4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
    - a. Metal.
    - b. Glass.
    - c. Porcelain enamel.
    - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

### 3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
1. Do not leave gaps between ends of sealant backings.

2. Do not stretch, twist, puncture, or tear sealant backings.
  3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
1. Place sealants so they directly contact and fully wet joint substrates.
  2. Completely fill recesses in each joint configuration.
  3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealant from surfaces adjacent to joints.
  2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.
- 3.4 CLEANING
- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.
- 3.5 PROTECTION
- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 9200

## SECTION 08 1113 - HOLLOW METAL DOORS AND FRAMES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes:
  - 1. Interior standard steel doors and frames.
  - 2. Exterior standard steel doors and frames.
- B. Related Requirements:
  - 1. Section 08 7100 "Door Hardware" for door hardware for hollow-metal doors.

#### 1.3 DEFINITIONS

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

#### 1.4 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

#### 1.5 PREINSTALLATION MEETINGS

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

#### 1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
7. Details of anchorages, joints, field splices, and connections.
8. Details of accessories.
9. Details of moldings, removable stops, and glazing.

C. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.7 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal doors and frames 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Airtec Corporation.

2. Ceco Door; ASSA ABLOY.
3. Curries Company; ASSA ABLOY.
4. Pioneer Industries.
5. Republic Doors and Frames.
6. Steelcraft; an Allegion brand.

## 2.2 PERFORMANCE 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 assemblies 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.
- B. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

## 2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2; SDI A250.4, Level B. .
  1. Doors:
    - a. Type: As indicated in the Door and Frame Schedule.
    - b. Thickness: 1-3/4 inches.
    - c. Face: Uncoated steel sheet, minimum thickness of 0.042 inch.
    - d. Edge Construction: Model 2, Seamless.
    - e. Core: Manufacturer's standard Kraft-paper honeycomb, Polystyrene, Polyurethane, Polyisocyanurate, or Vertical steel stiffener.
  2. Frames:
    - a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
    - b. Sidelite Frames: Fabricated from same thickness material as adjacent door frame.
    - c. Construction: Face welded.

## 2.4 EXTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2; SDI A250.4, Level B.
  - 1. Doors:
    - a. Type: As indicated in the Door and Frame Schedule.
    - b. Thickness: 1-3/4 inches.
    - c. Face: Metallic-coated steel sheet, minimum thickness of 0.042 inch, with minimum A40 coating.
    - d. Edge Construction: Model 2, Seamless.
    - e. Core: Manufacturer's standard Polystyrene, Polyurethane, Polyisocyanurate, or Vertical steel stiffener.
      - 1) Thermal-Rated doors: provide doors fabricated with thermal resistance value (R-value) of not less than 2.1 deg F c h x sq. ft./Btu when tested according to ASTM C 1363.
  - 2. Frames:
    - a. Materials: Metallic-coated steel sheet, minimum thickness of 0.053 inch, with minimum A40 coating.
    - b. Construction: Face welded.
  - 3. Exposed Finish: Prime.

## 2.5 FRAME ANCHORS

- A. Jamb Anchors:
  - 1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
  - 2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
  - 3. Postinstalled Expansion Anchor: Minimum 3/8-inch- diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
- C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.

- D. Material: 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.

## 2.6 MATERIALS

- A. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- C. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- D. 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.
- E. 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.
- F. Glazing: Comply with requirements in Section 08 8000 "Glazing."

## 2.7 FABRICATION

- A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.
- B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
  - 1. Sidelite 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 welding, or by rigid mechanical anchors.
  - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
  - 3. 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.



4. Terminated Stops: Terminate stops 6 inches above finish floor with a 45 -degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.
- C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; 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 BHMA A156.115 for preparing hollow-metal doors and frames for hardware.
- D. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted hairline joints.
1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
  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. Provide loose stops and moldings on inside of hollow-metal doors and frames.
  4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

## 2.8 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

### 3.2 INSTALLATION

- A. General: Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.
- B. Hollow-Metal Frames: Comply with SDI A250.11 or NAAMM-HMMA 840.
  - 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
    - a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
    - b. Install frames with removable stops located on secure side of opening.
  - 2. Fire-Rated Openings: Install frames according to NFPA 80.
  - 3. Floor Anchors: 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.
  - 4. Solidly pack mineral-fiber insulation inside frames.
  - 5. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
  - 6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
  - 7. Installation Tolerances: Adjust hollow-metal frames 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.
  - 8. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
  - 9. Smoke-Control Doors: Install doors according to NFPA 105.
- C. Glazing: Comply with installation requirements in Section 08 8000 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 CLEANING AND TOUCHUP

- A. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- B. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 08 1113

## SECTION 08 1416 - FLUSH WOOD DOORS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Solid-core doors with wood-veneer faces.
  - 2. Factory finishing flush wood doors.

#### 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. Samples for Verification:

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.
- B. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

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

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.
- B. 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.

1.7 WARRANTY

- A. A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Warping (bow, cup, or twist) more than 1/4 inch 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 Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Algoma Hardwoods, Inc.
  - 2. Eggers Industries.
  - 3. Graham Wood Doors; an Assa Abloy Group company.
  - 4. Marshfield Door Systems, Inc.
  - 5. Vancouver Door Company.
  - 6. VT Industries, Inc.
- B. Source Limitations: Obtain flush wood doors from single manufacturer.

## 2.2 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."
  - 1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.
  - 2. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.
- B. WDMA I.S.1-A Performance Grade: Heavy Duty .
- C. WDMA I.S.1-A Performance Grade:
  - 1. Heavy Duty unless otherwise indicated.
  - 2. Extra Heavy Duty: janitor's closets exits and where indicated.
  - 3. Standard Duty: Closets (not including janitor's closets) .
- D. 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.
- E. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.
- F. Particleboard-Core Doors:
  - 1. Particleboard: ANSI A208.1, Grade LD-2.
  - 2. Blocking: Provide wood blocking in particleboard-core doors asneeded to eliminate through-bolting hardware.
  - 3. Provide doors with glued-wood-stave or structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.

G. 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.

H. 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 needed to eliminate through-bolting hardware.
- 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: 475 lbf per WDMA T.M.-10.

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors :

- 1. Grade: Premium, with Grade A faces.
- 2. Species: White oak.
- 3. Cut: Rift cut.
- 4. Match between Veneer Leaves: Pleasing match.
- 5. Assembly of Veneer Leaves on Door Faces: Balance match.
- 6. Exposed Vertical Edges: Same species as faces or a compatible species - edge Type A.
- 7. Core: Particleboard or Structural composite lumber.
- 8. Construction: Five or seven plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering.
- 9. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.

2.4 LIGHT FRAMES

- A. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- thick, cold-rolled steel sheet; factory primed for paint finish; and approved for use in doors of 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. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 8000 "Glazing."

## 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 faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Factory finish doors.
- C. Factory finish doors that are indicated to receive transparent finish.
- D. Transparent Finish:
  - 1. Grade: Premium.
  - 2. Finish: WDMA TR-6 catalyzed polyurethane.
  - 3. Staining: Basis of design Marshfield Clear 0-95 .
  - 4. Effect: Open-grain finish.
  - 5. Sheen: Satin.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
  - 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
  - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.



### 3.2 INSTALLATION

- A. Hardware: For installation, see Section 08 7100 "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
  - 1. Install fire-rated doors according to NFPA 80.
  - 2. Install smoke- and draft-control doors according to NFPA 105.
- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
  - 1. Clearances: Provide 1/8 inch 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. 2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
  - 2. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

### 3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 1416

## SECTION 08 1433 - STILE AND RAIL WOOD DOORS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Interior stile and rail wood doors.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include details of construction.
  - 2. Include factory-finishing specifications.
- B. Shop Drawings: For stile and rail wood doors. Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data, including those for stiles, rails, panels, and moldings (sticking); and other pertinent data[.][, including the following:]
  - 1. Dimensions of doors for factory fitting.
  - 2. Locations and dimensions of mortises and holes for hardware.
  - 3. Undercuts.
  - 4. Requirements for veneer matching.
  - 5. Doors to be factory finished and finish requirements.
- C. Samples for Verification: Corner sections of doors, approximately 8 by 10 inches, with door faces and edgings representing typical range of color and grain for each species of veneer and solid lumber required. Finish Sample with same materials proposed for factory-finished doors.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.5 DELIVERY, STORAGE, AND HANDLING

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

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.
- B. 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.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship, or have warped (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section, within specified warranty period.
  - 1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
  - 2. Warranty shall be in effect during the following period of time from date of Substantial Completion:
    - a. Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain stile and rail wood doors from single manufacturer.

2.2 MATERIALS

- A. General: Use only materials that comply with referenced standards and other requirements specified.
  - 1. Assemble exterior doors and sidelites, including components, with wet-use adhesives complying with ASTM D 5572 for finger joints and with ASTM D 5751 for joints other than finger joints.

2. Assemble interior doors, including components, with either dry-use or wet-use adhesives complying with ASTM D 5572 for finger joints and with ASTM D 5751 for joints other than finger joints.
- B. Panel Products: Any of the following unless otherwise indicated:
1. Particleboard: ANSI A208.1, Grade M-2.
  2. Medium-density fiberboard, complying with ANSI A208.2, Grade 130.
  3. Hardboard complying with ANSI A135.4.
  4. Veneer-core plywood.
- C. Safety Glass: Provide products complying with testing requirements in 16 CFR 1201, for Category II materials, unless those of Category I are expressly indicated and permitted.

## 2.3 INTERIOR STILE AND RAIL WOOD DOORS

- A. Interior Stile and Rail Wood Doors: Interior stock doors complying with the AWI's, AWMAC's, and WI's "Architectural Woodwork Standards," and with other requirements specified.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Algoma Hardwoods, Inc.
    - b. Artistic Doors and Windows, Inc.
    - c. Dimension Millworks.
    - d. Eggers Industries.
    - e. ENJO Architectural Millwork.
    - f. Harring Doors.
    - g. Maiman Company (The).
    - h. Marshfield DoorSystems, Inc.
    - i. Pinecrest, Inc.
    - j. Woodtech.
  2. Panel Designs: Indicated on Drawings. 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.
  3. Grade: Premium.
  4. Finish: Transparent.
  5. Wood Species and Cut for Transparent Finish: White oak, quarter sawed/sliced stiles and rails, plain sawed/sliced panels.
  6. Door Construction for Transparent Finish:
    - a. Stile and Rail Construction: Clear lumber; may be edge glued for width. Select lumber for similarity of grain and color, and arrange for optimum match between adjacent pieces.
    - b. Stile and Rail Construction: Veneered, structural composite lumber or veneered, edge- and end-glued clear lumber. Select veneers for similarity of grain and color, and arrange for optimum match between adjacent pieces. Use veneers not less than 1/16 inch thick.

## 2.4 FINISHING

- A. Finish wood doors at factory.
- B. Transparent Finish:
  - 1. Grade: Premium.
  - 2. Finish: WDMA TR-6 catalyzed polyurethane.
  - 3. Staining: Basis of design Marshfiled Cleat 0-95.

## 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 08 7100 "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
- C. 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 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 08 1433

## SECTION 08 31 13 - ACCESS DOORS AND FRAMES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes access doors and frames for walls and ceilings.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.

### PART 2 - PRODUCTS

#### 2.1 ACCESS DOORS AND FRAMES

- A. Flush Access Doors with Exposed Flanges :
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Babcock-Davis.
    - b. JL Industries, Inc.; a division of the Activar Construction Products Group.
    - c. Karp Associates, Inc.
    - d. Larsens Manufacturing Company.
    - e. Milcor; Commercial Products Group of Hart & Cooley, Inc.
    - f. Nystrom, Inc.
  - 2. Description: Face of door flush with frame, with exposed flange and concealed hinge.
  - 3. Locations: Wall and ceiling.
  - 4. Door Size: See drawings.
  - 5. Uncoated Steel Sheet for Door: Nominal 0.060 inch , 16 gage, factory primed.
  - 6. Latch and Lock: Self latching hardware, operated by key in public areas.

## 2.2 FIRE-RATED ACCESS DOORS AND FRAMES

### A. Fire-Rated, Flush Access Doors with Exposed Flanges:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Acudor Products, Inc.
  - b. Babcock-Davis.
  - c. JL Industries, Inc.; a division of the Activar Construction Products Group.
  - d. Karp Associates, Inc.
  - e. Larsens Manufacturing Company.
  - f. Milcor; Commercial Products Group of Hart & Cooley, Inc.
  - g. Nystrom, Inc.
2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal; with exposed flange, self-closing door, and concealed hinge.
3. Locations: Wall and ceiling.
4. Door Size: See drawingsInsert door size.
5. Fire-Resistance Rating: Not less than that of adjacent construction.
6. Uncoated Steel Sheet for Door: Nominal 0.036 inch , 20 gage, factory primed.
7. Metallic-Coated Steel Sheet for Door: Nominal 0.040 inch , 20 gage, factory primed.
8. Latch and Lock: Self-latching door hardware, operated by key in public areas. .

## 2.3 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- C. Frame Anchors: Same material as door face.
- D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

## 2.4 FABRICATION

- A. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- B. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

C. Latch and Lock Hardware:

1. Quantity: Furnish number of latches and locks required to hold doors tightly closed.
2. Keys: Furnish two keys per lock and key all locks alike.

2.5 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
  1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

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

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 08 3113



## SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

### 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. Exterior and interior storefront framing.
- B. Related Requirements:
  - 1. Section 08 4126 "All-Glass Entrances and Storefronts" for systems without aluminum support framing.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
  - 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
  - 2. Include full-size isometric details of each vertical-to-horizontal intersection of aluminum-framed entrances and storefronts, showing the following:
    - a. Joinery, including concealed welds.
    - b. Anchorage.
    - c. Expansion provisions.
    - d. Glazing.
    - e. Flashing and drainage.
  - 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

- D. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:
  - 1. Joinery, including concealed welds.
  - 2. Anchorage.
  - 3. Expansion provisions.
  - 4. Glazing.
  - 5. Flashing and drainage.
- E. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.
  - 1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.
- B. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by a qualified testing agency.
- C. Quality-Control Program: Developed specifically for Project, including fabrication and installation, according to recommendations in ASTM C 1401. Include periodic quality-control reports.
- D. Sample Warranties: For special warranties.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.
- B. Maintenance Data for Structural Sealant: For structural-sealant-glazed storefront to include in maintenance manuals. Include ASTM C 1401 recommendations for post-installation-phase quality-control program.

#### 1.6 QUALITY ASSURANCE

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

- B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
  - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.
- C. Structural-Sealant Glazing: Comply with ASTM C 1401 for design and installation of storefront systems.

#### 1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including, but not limited to, excessive deflection.
    - b. Noise or vibration created by wind and thermal and structural movements.
    - c. Deterioration of metals[, metal finishes,] and other materials beyond normal weathering.
    - d. Water penetration through fixed glazing and framing areas.
    - e. Failure of operating components.
  - 2. Warranty Period: 10 years from date of Substantial Completion.
- B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - 2. Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
  - 1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
  - 2. Failure also includes the following:
    - a. Thermal stresses transferring to building structure.
    - b. Glass breakage.
    - c. Noise or vibration created by wind and thermal and structural movements.
    - d. Loosening or weakening of fasteners, attachments, and other components.
    - e. Failure of operating units.
- B. Structural Loads:
  - 1. Wind Loads: As indicated on Drawings.
- C. Deflection of Framing Members: At design wind pressure, as follows:
  - 1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding 1/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 inch, whichever is less.
  - 2. Deflection Parallel to Glazing Plane: Limited to 1/360 of clear span or 1/8 inch, whichever is smaller.
- D. Structural: Test according to ASTM E 330 as follows:
  - 1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
  - 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
  - 3. Test Durations: As required by design wind velocity, but not less than 10seconds.
- E. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
  - 1. Fixed Framing and Glass Area:
    - a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..

2. Entrance Doors:
  - a. Pair of Doors: Maximum air leakage of at a static-air-pressure differential of 1.57 lbf/sq. ft.
  - b. Single Doors: Maximum air leakage of at a static-air-pressure differential of 1.57 lbf/sq. ft.
- F. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
  1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. .
- G. Energy Performance: Certify and label energy performance according to NFRC as follows:
  1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.45 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
  2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.45 as determined according to NFRC 200.
  3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 15 as determined according to NFRC 500.
- H. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
  1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
  2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
    - a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
    - b. Low Exterior Ambient-Air Temperature: 0 deg F.
    - c. Interior Ambient-Air Temperature: 75 deg F.
- I. Structural-Sealant Joints:
  1. Designed to carry gravity loads of glazing.
  2. Designed to produce tensile or shear stress of less than 20 psi.
- J. Structural Sealant: Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed storefront system without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.
  1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.

2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate because sealant-to-substrate bond strength exceeds sealant's internal strength.

## 2.2 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Manko 2650 or comparable product by one of the following:
  1. EFCO Corporation.
  2. Kawneer North America.
  3. TRACO.
  4. Tubelite.
  5. United States Aluminum.
- B. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing [spandrel panels] [venting windows] and accessories, from single manufacturer.

## 2.3 FRAMING

- A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
  1. Construction: Thermally broken.
  2. Glazing System: Retained mechanically with gaskets on four sides.
  3. Glazing Plane: Front.
  4. Finish: Color anodic finish.
  5. Fabrication Method: Field-fabricated stick system.
- B. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- D. Materials:
  1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
    - a. Sheet and Plate: ASTM B 209.
    - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
    - c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
    - d. Structural Profiles: ASTM B 308/B 308M.

2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.
  - a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
  - b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
  - c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

## 2.4 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
  1. Door Construction: 2- to 2-1/4-inch overall thickness, with minimum 0.125-inch-thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
    - a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.
  2. Door Design: Wide stile; 5-inch nominal width.

## 2.5 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 08 7100 "Door Hardware."
- B. General: Provide entrance door hardware and entrance door hardware sets indicated in door and frame schedule for each entrance door to comply with requirements in this Section.
  1. Entrance Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products.
  2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
  3. Opening-Force Requirements:
    - a. Egress Doors: Not more than 15 lbf to release the latch and not more than 30 lbft to set the door in motion and not more than 15 lbf to open the door to its minimum required width.
    - b. Accessible Interior Doors: Not more than 5 lbf to fully open door.

- C. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of entrance door hardware are indicated in "Entrance Door Hardware Sets" Article. Products are identified by using entrance door hardware designations as follows:
  - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in "Entrance Door Hardware Sets" Article.
  - 2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.
- D. Strikes: Provide strike with black-plastic dust box for each latch or lock bolt; fabricated for aluminum framing.
- E. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
- F. Silencers: BHMA A156.16, Grade 1.
- G. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of 1/2 inch.

## 2.6 GLAZING

- A. Glazing: Comply with Section 08 8000 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.
- C. Glazing Sealants: As recommended by manufacturer.

## 2.7 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
  - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
  - 2. Reinforce members as required to receive fastener threads.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
  - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A 123/A 123M or ASTM A 153/A 153M requirements.



- C. Concealed Flashing: [Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials] [Dead-soft, 0.018-inch- thick stainless steel, ASTM A 240/A 240M of type recommended by manufacturer].
- D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-milthickness per coat.

## 2.8 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Fabricate components that, when assembled, have the following characteristics:
  - 1. Profiles that are sharp, straight, and free of defects or deformations.
  - 2. Accurately fitted joints with ends coped or mitered.
  - 3. Physical and thermal isolation of glazing from framing members.
  - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
  - 5. Provisions for field replacement of glazing from interior.
  - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- C. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- D. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
  - 1. At exterior doors, provide compression weather stripping at fixed stops.
  - 2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.
- E. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
  - 1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
  - 2. At exterior doors, provide weather sweeps applied to door bottoms.
- F. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- G. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

## 2.9 ALUMINUM FINISHES

- A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
  - 1. Color: Black.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Prepare surfaces that are in contact with structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

### 3.3 INSTALLATION

- A. General:
  - 1. Comply with manufacturer's written instructions.
  - 2. Do not install damaged components.
  - 3. Fit joints to produce hairline joints free of burrs and distortion.
  - 4. Rigidly secure nonmovement joints.
  - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
  - 6. Seal perimeter and other joints watertight unless otherwise indicated.
- B. Metal Protection:
  - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
  - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Set continuous sill members and flashing in full sealant bed as specified in Section 07 9200 "Joint Sealants" to produce weathertight installation.
- D. Install components plumb and true in alignment with established lines and grades.
- E. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.
- F. Install glazing as specified in Section 08 8000 "Glazing."

- G. Install weatherseal sealant according to Section 07 9200 "Joint Sealants" and according to sealant manufacturer's written instructions to produce weatherproof joints. Install joint filler behind sealant as recommended by sealant manufacturer.
- H. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
  - 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
  - 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

### 3.4 ERECTION TOLERANCES

- A. Erection Tolerances: Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
  - 1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
  - 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
  - 3. Alignment:
    - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
    - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
    - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
  - 4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

### 3.5 MAINTENANCE SERVICE

- A. Entrance Door Hardware:
  - 1. 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 entrance door hardware.
  - 2. Initial Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Use parts and supplies that are the same as those used in the manufacture and installation of original equipment.

END OF SECTION 08 4113

## SECTION 08 4126 - ALL-GLASS ENTRANCES AND STOREFRONTS

### 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 swinging all-glass entrance doors.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for all-glass system.
- B. Shop Drawings: For all-glass entrances and storefronts.
  - 1. Include plans, elevations, and sections.
  - 2. Door hardware locations, mounting heights, and installation requirements.
- C. Samples for Verification: For each type of exposed finish indicated, prepared on Samples of size indicated below.
  - 1. Metal Finishes: 6-inch- long sections of patch fittings and rail fittings, accessory fittings, and other items.
  - 2. Glass: 6 inches square, showing exposed-edge finish[ and tint].
  - 3. Door Hardware: For exposed door hardware of each type, in specified finish, full size.
- D. Fabrication Sample: Patch fitting at sill on pivot side only Insert requirements, made from 12-inch lengths of full-size components and showing details of the following:
  - 1. Joinery.
  - 2. Anchorage.
  - 3. Glazing.
- E. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For all-glass systems to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
  - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of all-glass systems that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including excessive deflection, air infiltration, or water leakage.
    - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
    - c. Failure of operating components.
  - 2. Warranty Period: Two years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of all-glass entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Structural Loads:
  - 1. Wind Loads: As indicated on Drawings.
  - 2. Deflection Limits: Deflection normal to glazing plane is limited to 1 inch.
- C. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

### 2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Alpha Door & Rail, Inc.
  - 2. Arch Aluminum & Glass Co., Inc.
  - 3. Avanti Systems, Inc.
  - 4. Blumcraft of Pittsburgh; C.R. Laurence Co, Inc.
  - 5. Doralco Architectural Metals.
  - 6. Oldcastle BuildingEnvelope.
  - 7. Virginia Glass Products Corporation.
  - 8. Vitro America.

### 2.3 METAL COMPONENTS

- A. Fitting Configuration:
  - 1. Manual-Swinging, All-Glass Entrance Doors : Patch fittings at head and sill on pivot side, and for lock at sill of swing side.
- B. Patch Fittings: Stainless-steel-clad aluminum.
- C. Rail Fittings:
  - 1. Profile: Tapered.
- D. Anchors and Fastenings: Concealed.

E. Materials:

1. Aluminum: ASTM B 221, with strength and durability characteristics of not less than Alloy 6063-T5.
  - a. Color: Black.

2.4 GLASS

- A. Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated surfaces), Type I (transparent), tested for surface and edge compression per ASTM C 1048 and for impact strength per 16 CFR 1201 for Category II materials.
  1. Class 1: Clear monolithic.
    - a. Thickness: 1/2 inch.
  2. Exposed Edges: Machine ground and flat polished.

2.5 ENTRANCE DOOR HARDWARE

- A. General: Heavy-duty entrance door hardware units in sizes, quantities, and types recommended by manufacturer for all-glass entrance systems indicated. For exposed parts, match metal and finish of patch fittings.
- B. Concealed Floor Closers and Top Pivots: Center hung; BHMA A156.4, Grade 1; including cases, bottom arms, top walking beam pivots, plates, and accessories required for complete installation.
  1. Swing: Single acting.
  2. Push pulls/bars and locks manufacturers standard options coordinate with architect.

2.6 BUTT-GLAZING SEALANTS

- A. Single-Component, Nonsag, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Uses NT, G, and A.

2.7 FABRICATION

- A. Provide holes and cutouts in glass to receive hardware, fittings, and accessory fittings before tempering glass. Do not cut, drill, or make other alterations to glass after tempering.
  1. Fully temper glass using horizontal (roller-hearth) process, and fabricate so that when glass is installed, roll-wave distortion is parallel with bottom edge of door or lite.

- B. Factory assemble components and factory install hardware and fittings to greatest extent possible.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Install all-glass systems and associated components according to manufacturer's written instructions.
- B. Set units level, plumb, and true to line, with uniform joints.
- C. Maintain uniform clearances between adjacent components.
- D. Lubricate hardware and other moving parts according to manufacturer's written instructions.
- E. Set, seal, and grout floor closer cases as required to suit hardware and substrate indicated.

#### 3.3 ADJUSTING AND CLEANING

- A. Adjust all-glass entrance doors and hardware to produce smooth operation and tight fit at contact points and weather stripping.
  - 1. For all-glass entrance doors accessible to people with disabilities, adjust closers to provide a three-second closer sweep period for doors to move from a 70-degree open position to 3 inches from the latch measured to the leading door edge.
- B. Remove excess sealant and glazing compounds and dirt from surfaces.

END OF SECTION 08 4126



## SECTION 08 4413 - GLAZED ALUMINUM CURTAIN WALLS

### 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 glazed aluminum curtain walls.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: For glazed aluminum curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.
  - 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
  - 2. Include full-size isometric details of each vertical-to-horizontal intersection of glazed aluminum curtain walls, showing the following:
    - a. Joinery, including concealed welds.
    - b. Anchorage.
    - c. Expansion provisions.
    - d. Glazing.
    - e. Flashing and drainage.
  - 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Preconstruction Laboratory Mockup Testing Submittals:
  - 1. Test Reports: Prepared by a qualified preconstruction testing agency for each mockup test.

- B. Product Test Reports: For glazed aluminum curtain walls, for tests performed by a qualified testing agency.
- C. Sample Warranties: For special warranties.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For glazed aluminum curtain walls 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 WARRANTY

- A. Special Assembly Warranty: Manufacturer agrees to repair or replace components of glazed aluminum curtain wall that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Structural failures including, but not limited to, excessive deflection.
- b. Noise or vibration created by wind and thermal and structural movements.
- c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- d. Water penetration through fixed glazing and framing areas.
- e. Failure of operating components.

2. Warranty Period: 10 years from date of Substantial Completion.

- B. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

- a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.
- b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
- c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
  - 1. Glazed aluminum curtain walls shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
  - 2. Failure also includes the following:
    - a. Thermal stresses transferring to building structure.
    - b. Glass breakage.
    - c. Noise or vibration created by wind and thermal and structural movements.
    - d. Loosening or weakening of fasteners, attachments, and other components.
    - e. Failure of operating units.
- B. Structural Loads:
  - 1. Wind Loads: As indicated on Drawings.
- C. Structural: Test according to ASTM E 330 as follows:
  - 1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
  - 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
  - 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- D. Air Infiltration: Test according to ASTM E 283 for infiltration as follows:
  - 1. Fixed Framing and Glass Area:
    - a. Maximum air leakage of 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..
- E. Water Penetration under Static Pressure: Test according to ASTM E 331 as follows:
  - 1. No evidence of water penetration through fixed glazing and framing areas when tested according to a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft. .
  - 2. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..

- F. Energy Performance: Certify and label energy performance according to NFRC as follows:
1. Thermal Transmittance (U-factor): Fixed glazing and framing areas shall have U-factor of not more than 0.45 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
  2. Solar Heat Gain Coefficient: Fixed glazing and framing areas shall have a solar heat gain coefficient of no greater than 0.45 as determined according to NFRC 200.
  3. Condensation Resistance: Fixed glazing and framing areas shall have an NFRC-certified condensation resistance rating of no less than 15 as determined according to NFRC 500.
- G. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
  2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested according to AAMA 501.5.
    - a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
    - b. Low Exterior Ambient-Air Temperature: 0 deg F.

## 2.2 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Manko 250 or comparable product by one of the following:
1. EFCO Corporation.
  2. Kawneer North America; an Alcoa company.
  3. TRACO.
  4. Tubelite.
  5. United States Aluminum.
- B. Source Limitations: Obtain all components of curtain wall system, including framing and accessories, from single manufacturer.

## 2.3 FRAMING

- A. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
1. Construction: Thermally broken.
  2. Glazing System: Retained mechanically with gaskets on four sides.
  3. Glazing Plane: Front.
  4. Finish: Color anodic finish.
  5. Fabrication Method: Field-fabricated stick system.

- B. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.
  - 1. Include snap-on aluminum trim that conceals fasteners.
- C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- D. Materials:
  - 1. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
    - a. Sheet and Plate: ASTM B 209.
    - b. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
    - c. Extruded Structural Pipe and Tubes: ASTM B 429/B 429M.
    - d. Structural Profiles: ASTM B 308/B 308M.
  - 2. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM, and prepare surfaces according to applicable SSPC standard.
    - a. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
    - b. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
    - c. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

## 2.4 ENTRANCES

- A. Entrances: Comply with Section 08 4113 "Aluminum-Framed Entrances and Storefronts."

## 2.5 GLAZING

- A. Glazing: Comply with Section 08 8000 "Glazing."

## 2.6 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
  - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
  - 2. Reinforce members as required to receive fastener threads.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

- C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- D. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos, formulated for 30-mil thickness per coat.

## 2.7 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Fabricate components that, when assembled, have the following characteristics:
  - 1. Profiles that are sharp, straight, and free of defects or deformations.
  - 2. Accurately fitted joints with ends coped or mitered.
  - 3. Physical and thermal isolation of glazing from framing members.
  - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
  - 5. Provisions for field replacement of glazing from interior.
- C. Fabricate components to resist water penetration as follows:
  - 1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
  - 2. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.
- D. Curtain-Wall Framing: Fabricate components for assembly using manufacturer's standard assembly method.
- E. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

## 2.8 ALUMINUM FINISHES

- A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
  - 1. Color: Black.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

### 3.3 INSTALLATION

#### A. General:

1. Comply with manufacturer's written instructions.
2. Do not install damaged components.
3. Fit joints to produce hairline joints free of burrs and distortion.
4. Rigidly secure nonmovement joints.
5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
6. Seal joints watertight unless otherwise indicated.

#### B. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum is in contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

- C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

- D. Install components plumb and true in alignment with established lines and grades.

### 3.4 ERECTION TOLERANCES

- A. Erection Tolerances: Install glazed aluminum curtain walls to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:
  - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
  - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
  - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.

4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

END OF SECTION 08 4413



## SECTION 08 4523 - FIBERGLASS-SANDWICH-PANEL ASSEMBLIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes aluminum-framed assemblies incorporating fiberglass-sandwich panels as follows:
  - 1. Skylight assemblies.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum components of panel assemblies.
- B. Shop Drawings: For panel assemblies.
  - 1. Include plans, elevations, sections, details, and attachments to other work.
  - 2. Include details of provisions for assembly expansion and contraction and for draining moisture within the assembly to the exterior.
- C. Samples: In manufacturer's standard size.
  - 1. For each type of fiberglass-sandwich panel.
  - 2. For each type of exposed finish for framing members.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Product Test Reports: For each fiberglass-sandwich-panel assembly, for tests performed by a qualified testing agency.
- C. Sample Warranties: For special warranties.

1.5 CLOSEOUT SUBMITTALS

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

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: For fiberglass-sandwich panels, a qualified manufacturer whose facilities, processes, and products are monitored by an independent, accredited quality-control agency for compliance with applicable requirements in ICC-ES AC04 or ICC-ES AC177.
- B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.7 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of panel assemblies that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including, but not limited to, excessive deflection.
    - b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
    - c. Water leakage.
  - 2. Warranty Period: Five years from date of Substantial Completion.
- B. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace fiberglass-sandwich panels that exhibit defects in materials or workmanship within specified warranty period.
  - 1. Defects include, but are not limited to, the following:
    - a. Fiberbloom.
    - b. Delamination of coating, if any, from exterior face sheet.
    - c. Color change exceeding requirements.
    - d. Delamination of panel face sheets from panel cores.
  - 2. Warranty Period: 10 years from date of Substantial Completion.
- C. Special Aluminum-Finish Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period. Warranty does not include normal weathering.
  - 1. Failures include, but are not limited to, checking, crazing, peeling, chalking, and fading of finishes.
  - 2. Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Structural Loads: As indicated on Drawings.
- B. Structural-Test Performance: Provide panel assemblies tested according to ASTM E 330, as follows:
  - 1. When tested at positive and negative wind-load design pressures, assemblies do not show evidence of deflection exceeding specified limits.
  - 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not show evidence of material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
  - 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- C. Water Penetration under Static Pressure: Provide panel assemblies that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..
- D. Water Penetration under Dynamic Pressure: Provide panel assemblies that do not evidence water leakage through fixed glazing and framing areas when tested according to AAMA 501.1 under dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..
  - 1. Maximum Water Leakage: According to AAMA 501.1. Water leakage does not include water that is controlled by flashing and gutters and drained to the exterior, or water that cannot damage adjacent materials or finishes.
- E. Thermal Movements: Allow for thermal movements from ambient- and surface-temperature changes. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  - 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
  - 2. Thermal Transmittance (U-Factor): Fixed glazing and framing areas shall have U-factor of not more than 0.80 Btu/sq. ft. x h x deg F as determined according to NFRC 100.
  - 3. Solar Heat Gain Coefficient (SHGC): Fixed glazing and framing areas shall have a SHGC of no greater than 0.6 as determined according to NFRC 200.
  - 4. Air Infiltration: Maximum air leakage through fixed glazing and framing areas of 0.30 cfm/sq. ft. of fixed wall area as determined according to ASTM E 283 at a minimum static-air-pressure differential of 1.57 lbf/sq. ft..

## 2.2 FIBERGLASS-SANDWICH-PANEL ASSEMBLIES

- A. Fiberglass-Sandwich-Panel Assemblies: Translucent assemblies that are supported by aluminum framing and glazed with fiberglass-sandwich panels.

1. Basis-of-Design Product: Subject to compliance with requirements, provide
  - a. Kalwall Corporation.

## 2.3 FIBERGLASS-SANDWICH PANELS

- A. Fiberglass-Sandwich Panels: Uniformly colored, translucent, thermoset, fiberglass-reinforced-polymer face sheets bonded to both sides of a grid core.

1. Core Insulation: Fill panel cores with aerogel or manufactures standard.

- B. Panel Thickness: 2-3/4 inches.

- C. Panel Size and quantity: (1) 4'x16' S-Line Skylight including RPI premanufactured 1" insulated curb with 3/8" per foot slope.

- D. Light transmission: 26%

- E. Solar heat gain coefficient: .28.

- F. Panel U-factor by NFRC certified laboratory: 2-3/4" thermally broken grid .23U.

- G. Complete insulated panel system shall have NFRC certified U-factor of .28U.

- H. Grid Pattern: Nominal size 12 x 24"; pattern Shoji.

- I. Panel Components

1. Face Sheets

- a. Translucent faces: Manufactured from glass fiber reinforced thermoset resins, formulated specifically for architectural use.
- b. Face sheets shall not deform, deflect or drip when subjected to fire or flame.

- J. Grid Core: Mechanically interlocked, extruded-aluminum I-beams, with a minimum flange width of 7/16 inch.

- K. Exterior Face Sheet:

1. Thickness: 0.070 inch.
2. Color: Crystal .
3. Protective Weathering Surface: Manufacturer's standard.

L. Interior Face Sheet:

1. Thickness: 0.045 inch.
2. Color: White .

M. Fiberglass-Sandwich-Panel Adhesive: Manufacturer's standard for permanent adhesion of facings to cores.

N. Panel Strength:

1. Maximum Panel Deflection: 3-1/2 inches when a 4-by-12-foot panel is tested according to ASTM E 72 at 34 lbf/sq. ft., with a maximum 0.090-inch set deflection after five minutes.
2. Panel Support Strength: Capable of supporting, without failure, a 300-lbf concentrated load when applied to a 3-inch- diameter disk according to ASTM E 661.

O. Panel Performance:

1. Self-Ignition Temperature: 650 deg F or more according to ASTM D 1929.
2. Smoke-Developed Index: 450 or less according to ASTM E 84, or 75 or less according to ASTM D 2843.
3. Color Change: Not more than 3.0 units Delta E, when measured according to ASTM D 2244, after outdoor weathering compliant with procedures in ASTM D 1435.
  - a. Outdoor Weathering Conditions: Sixty months in southern Florida.

## 2.4 ALUMINUM FRAMING SYSTEMS

A. Components: Manufacturer's standard extruded-aluminum members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken, extruded aluminum.

B. Aluminum: Alloy and temper recommended in writing by manufacturer for type of use and finish indicated.

1. Sheet and Plate: ASTM B 209.
2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
3. Extruded Structural Pipe and Tubes: ASTM B 429.
4. Structural Profiles: ASTM B 308.

C. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning skylight components.

D. Fasteners and Accessories: Manufacturer's standard, corrosion-resistant, nonstaining, and nonbleeding fasteners and accessories; compatible with adjacent materials.

1. At closures, retaining caps, or battens, use ASTM A 193, 300 series stainless-steel screws.

2. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
  3. At movement joints, use slip-joint linings, spacers, and sleeves of material and type recommended in writing by manufacturer.
- E. Anchor Bolts: ASTM A 307, Grade A, galvanized steel.
- F. Concealed Flashing: Corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- G. Framing Gaskets: Manufacturer's standard.

## 2.5 FABRICATION

- A. Frame System Fabrication:
1. Fabricate components that, when assembled, have the following characteristics:
    - a. Profiles that are sharp, straight, and free of defects or deformations.
    - b. Accurately fitted joints with ends coped or mitered.
    - c. Internal guttering systems or other means to drain water passing through joints, and moisture migrating within assembly to exterior.
  2. Fabricate sill closures with weep holes and for installation as continuous component.
  3. Reinforce components as required to receive fastener threads.
- B. Panel Fabrication: Factory assemble and seal panels.
1. Laminate face sheets to grid core under a controlled process using heat and pressure to produce straight adhesive bonding lines that cover width of core members and that have sharp edges.
    - a. White spots indicating lack of bond at intersections of grid-core members are limited in number to four for every 40 sq. ft. of panel and limited in diameter to 3/64 inch.
  2. Fabricate with grid pattern that is symmetrical about centerlines of each panel.
  3. Fabricate panel to allow condensation within panel to escape.
  4. Reinforce panel corners.

## 2.6 ALUMINUM FINISHES

- A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
1. Color: Black.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General: Comply with manufacturer's written instructions.
  - 1. Do not install damaged components.
  - 2. Fit joints between aluminum components to produce hairline joints free of burrs and distortion.
  - 3. Rigidly secure nonmovement joints.
  - 4. Install anchors with separators and isolators to prevent metal corrosion, electrolytic deterioration, and immobilization of moving joints.
  - 5. Seal joints watertight unless otherwise indicated.
- B. Metal Protection: Where aluminum components will contact dissimilar materials, protect against galvanic action by painting contact surfaces with corrosion-resistant coating or by installing nonconductive spacers as recommended in writing by manufacturer for this purpose.
- C. Install components plumb and true in alignment with established lines and elevations.
- D. Skylight Assemblies: Install continuous aluminum sill closures with weatherproof expansion joints and locked and sealed corners. Locate weep holes at rafters. Install components to drain water passing through joints and moisture migrating within assembly to exterior.
- E. Erection Tolerances: Install panel assemblies to comply with the following maximum tolerances:
  - 1. Alignment: Limit offset from true alignment to 1/32 inch where surfaces abut in line, edge to edge, at corners, or where a reveal or protruding element separates aligned surfaces by less than 3 inches; otherwise, limit offset to 1/8 inch.
  - 2. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet, but no greater than 1/2 inch over total length.

END OF SECTION 08 4523

## SECTION 08 5200 - WOOD WINDOWS

### 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 wood windows and aluminum-clad wood windows.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for wood windows.
- B. Shop Drawings: For wood windows.
  - 1. Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.
- C. Samples for Verification: For wood windows and components required, prepared on Samples of size indicated below:
  - 1. Exposed Finishes: 2 by 4 inches .
  - 2. Exposed Hardware: Full-size units.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Field quality-control reports.
- C. Sample Warranties: For manufacturer's warranties.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An installer acceptable to wood window manufacturer for installation of units required for this Project.



## 1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace wood windows that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

- a. Failure to meet performance requirements.
- b. Structural failures including excessive deflection, water leakage, and air infiltration.
- c. Faulty operation of movable sash and hardware.
- d. Deterioration of materials and finishes beyond normal weathering.
- e. Failure of insulating glass.

2. Warranty Period:

- a. Window: 10 years from date of Substantial Completion.
- b. Glazing Units: 10 years from date of Substantial Completion.
- c. Aluminum-Cladding Finish: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain wood windows from single source from single manufacturer.

### 2.2 WINDOW PERFORMANCE REQUIREMENTS

- A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Window Certification: WDMA certified with label attached to each window.

- B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:

1. Minimum Performance Class: LC.
2. Minimum Performance Grade: 25.

- C. Thermal Transmittance: NFRC 100 maximum whole-window U-factor of 0.32 Btu/sq. ft. x h x deg F.

- D. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.30.

## 2.3 WOOD WINDOWS

### A. Aluminum-Clad Wood Windows:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Marvin; Clad Double Hung Magnum, or comparable product by one of the following:
  - a. Crestline Windows and Doors.
  - b. Jeld-Wen, Inc.
  - c. Pella Corporation.
  - d. Quaker Construction Products, Inc.
  - 1) Include sill extensions historic putty glazed appearance see drawings for details.

### B. Wood Windows:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Marvin Wood Ultimate Double Hung Magnum or comparable product by one of the following:
  - a. Crestline Windows and Doors.
  - b. Jeld-Wen, Inc.
  - c. Pella Corporation.
  - d. Weather Shield Mfg., Inc.
  - 1) See drawings for brick mold and custom sills required for installation.

### C. Operating Types: Provide the following operating types in locations indicated on Drawings:

1. Double hung.

### D. Frames and Sashes: Fine-grained wood lumber complying with AAMA/WDMA/CSA 101/I.S.2/A440; kiln dried to a moisture content of not more than 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch deep by 2 inches wide; water-repellent preservative treated.

1. Exterior Finish: Aluminum-clad or wood.
  - a. Aluminum Finish: Manufacturer's standard fluoropolymer two-coat system with fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight and complying with AAMA 2605.
  - b. Color: As selected by Architect from manufacturer's full range.
2. Interior Finish: Prime.

E. Insulating-Glass Units: ASTM E 2190.

1. Glass: ASTM C 1036, Type 1, Class 1, q3.
  - a. Tint: Clear.
  - b. Kind: Fully tempered where indicated on Drawings.
2. Lites: Two.
3. Filling: Fill space between glass lites with argon.
4. Low-E Coating: Sputtered on second or third surface.

F. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.

1. Exposed Hardware Color and Finish: As selected by Architect from manufacturer's full range.

G. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

2.4 INSECT SCREENS

A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.

1. Type and Location: sashes.

2.5 FABRICATION

A. Fabricate wood windows in sizes indicated. Include a complete system for installing and anchoring windows.

B. Glaze wood windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design wind loads of window units.

1. Angled mullion posts with interior and exterior trim.
2. Angled interior and exterior extension and trim.
3. Clear pine head and seat boards.

4. Top and bottom plywood platforms.
  5. Exterior head and sill casings and trim.
  6. Support brackets.
- E. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.
- C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E 2112.
- B. Install windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

#### 3.3 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.
- B. Clean exposed surfaces immediately after installing windows. Remove excess sealants, glazing materials, dirt, and other substances.
  1. Keep protective films and coverings in place until final cleaning.
- C. Remove and replace sashes if glass has been broken, chipped, cracked, abraded, or damaged during construction period.

- D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written instructions.

END OF SECTION 08 5200

## SECTION 08 7100 – DOOR HARDWARE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
  - 1. Swinging doors.
  - 2. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
  - 1. Mechanical door hardware.
  - 2. Electromechanical door hardware.
  - 3. Automatic operators.
- C. Related Sections:
  - 1. Division 08 Section "Hollow Metal Doors and Frames".
  - 2. Division 08 Section "Flush Wood Doors".
  - 3. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
  - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
  - 2. ICC/IBC - International Building Code.
  - 3. NFPA 70 - National Electrical Code.
  - 4. NFPA 80 - Fire Doors and Windows.
  - 5. NFPA 101 - Life Safety Code.
  - 6. NFPA 105 - Installation of Smoke Door Assemblies.
  - 7. UL/ULC and CSA C22.2 – Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
  - 8. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards:
  - 1. ANSI/BHMA Certified Product Standards - A156 Series
  - 2. UL10C – Positive Pressure Fire Tests of Door Assemblies

### 1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
  - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
  - 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
  - 3. Content: Include the following information:
    - a. Type, style, function, size, label, hand, and finish of each door hardware item.
    - b. Manufacturer of each item.
    - c. Fastenings and other pertinent information.
    - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    - e. Explanation of abbreviations, symbols, and codes contained in schedule.
    - f. Mounting locations for door hardware.
    - g. Door and frame sizes and materials.
    - h. Warranty information for each product.
  - 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Shop Drawings: Details of electrified access control hardware indicating the following:
  - 1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
    - a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
    - b. Complete (risers, point-to-point) access control system block wiring diagrams.

- c. Wiring instructions for each electronic component scheduled herein.
  - 2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
  - D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
  - E. Informational Submittals:
    - 1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
  - F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals.
- 1.4 QUALITY ASSURANCE
- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
  - B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
  - C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
  - D. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
    - 1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
    - 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.



- E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
  - F. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
    - 1. Function of building, purpose of each area and degree of security required.
    - 2. Plans for existing and future key system expansion.
    - 3. Requirements for key control storage and software.
    - 4. Installation of permanent keys, cylinder cores and software.
    - 5. Address and requirements for delivery of keys.
  - G. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
    - 1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
    - 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
    - 3. Review sequence of operation narratives for each unique access controlled opening.
    - 4. Review and finalize construction schedule and verify availability of materials.
    - 5. Review the required inspecting, testing, commissioning, and demonstration procedures
  - H. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.
- 1.5 DELIVERY, STORAGE, AND HANDLING
- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
  - B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

#### 1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.
- C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

#### 1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
  - 1. Structural failures including excessive deflection, cracking, or breakage.
  - 2. Faulty operation of the hardware.
  - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  - 4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
  - 1. Ten years for mortise locks and latches.
  - 2. Seven years for heavy duty cylindrical (bored) locks and latches.
  - 3. Five years for exit hardware.

4. Twenty five years for manual surface door closer bodies.
5. Five years for motorized electric latch retraction exit devices.
6. Two years for electromechanical door hardware.

## 1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

## PART 2 - PRODUCTS

### 2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
  1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

### 2.2 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles as specified in the Door Hardware Sets.
  1. Quantity: Provide the following hinge quantity, unless otherwise indicated:
    - a. Two Hinges: For doors with heights up to 60 inches.
    - b. Three Hinges: For doors with heights 61 to 90 inches.
    - c. Four Hinges: For doors with heights 91 to 120 inches.
    - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
  - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
  - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
  - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
  - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
4. Hinge Options: Comply with the following:
  - a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
5. Acceptable Manufacturers:
  - a. Hager Companies (HA).
  - b. McKinney Products; ASSA ABLOY Architectural Door Accessories (MK).
  - c. Stanley Hardware (ST).

## 2.3 POWER TRANSFER DEVICES

- A. Concealed Quick Connect Electric Power Transfers: Provide concealed wiring pathway housing mortised into the door and frame for low voltage electrified door hardware. Furnish with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.
  1. Acceptable Manufacturers:
    - a. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE) – EL-CEPT Series.
    - b. Securitron (SU) - EL-CEPT Series.
    - c. Von Duprin (VD) - EPT-10 Series.
- B. Provide mortar guard enclosure on steel frames installed at masonry openings for each electrical hinge specified.

## 2.4 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.
  - 1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
  - 2. Furnish dust proof strikes for bottom bolts.
  - 3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
  - 4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
  - 5. Acceptable Manufacturers:
    - a. Door Controls International (DC).
    - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    - c. Trimco (TC).
- B. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
  - 1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
  - 2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
  - 3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
  - 4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
  - 5. Acceptable Manufacturers:
    - a. Hiawatha, Inc. (HI).
    - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    - c. Trimco (TC).

## 2.5 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.

- C. Cylinders: Original manufacturer cylinders complying with the following:
1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
  2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
  3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
  4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
  5. Keyway: Manufacturer's Standard.
- D. Patented Cylinders: ANSI/BHMA A156.5, Grade 1, certified patented cylinders employing a utility patented and restricted keyway requiring the use of a patented key. Cylinders are to be protected from unauthorized manufacture and distribution by manufacturer's United States patents. Cylinders are to be factory keyed with owner having the ability for on-site original key cutting.
1. Acceptable Manufacturers:
    - a. Sargent Manufacturing (SA) - XC Series.
    - b. Schlage Lock (SC) - Everest D Series.
    - c. Stanley Best (BE) - 1CK Best/Peaks Series.
- E. Keying System: Each type of lock and cylinders to be factory keyed.
1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
  2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
  3. New System: Key locks to a new key system as directed by the Owner.
- F. Key Quantity: Provide the following minimum number of keys:
1. Change Keys per Cylinder: Two (2)
  2. Master Keys (per Master Key Level/Group): Five (5).
  3. Construction Keys (where required): Ten (10).
- G. Construction Keying: Provide construction master keyed cylinders.
- H. Key Registration List (Bitting List):
1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
  2. Provide transcript list in writing or electronic file as directed by the Owner.

- I. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Acceptable Manufacturers:

- a. Lund Equipment (LU).
    - b. MMF Industries (MM).
    - c. Telkee (TK).

## 2.6 MECHANICAL LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

1. Acceptable Manufacturers:

- a. Sargent Manufacturing (SA) – 8200 Series.
    - b. Schlage (SC) – L9000 Series.
    - c. Stanley Best (BE) – 40H-UN Series.

- B. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Grade 1 certified.

1. Furnish with solid cast levers, standard 2 3/4" backset, and 1/2" (3/4" at rated paired openings) throw brass or stainless steel latchbolt.
  2. Locks are to be non-handed and fully field reversible.
  3. Acceptable Manufacturers:

- a. Sargent Manufacturing (SA) – 10 Line.
    - b. Schlage (SC) – ND Series.
    - c. Stanley Best (BE) – 9K Series.

## 2.7 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
  2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
  3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
  4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.8 ELECTRIC STRIKES

A. Standard Electric Strikes: Heavy duty, cylindrical and mortise lock electric strikes conforming to ANSI/BHMA A156.31, Grade 1, UL listed for both Burglary Resistance and for use on fire rated door assemblies. Stainless steel construction with dual interlocking plunger design tested to exceed 3000 lbs. of static strength and 350 ft-lbs. of dynamic strength. Strikes tested for a minimum 1 million operating cycles. Provide strikes with 12 or 24 VDC capability and supplied standard as fail-secure unless otherwise specified. Option available for latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike.

1. Acceptable Manufacturers:

- a. Folger Adam EDC (FO).
- b. HES (HS).

B. Surface Mounted Rim Electric Strikes: Surface mounted rim exit device electric strikes conforming to ANSI/BHMA A156.31, Grade 1, and UL Listed for both Burglary Resistance and for use on fire rated door assemblies. Construction includes internally mounted solenoid with two heavy-duty, stainless steel locking mechanisms operating independently to provide tamper resistance. Strikes tested for a minimum of 500,000 operating cycles. Provide strikes with 12 or 24 VDC capability supplied standard as fail-secure unless otherwise specified. Option available for latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike. Strike requires no cutting to the jamb prior to installation.

1. Acceptable Manufacturers:

- a. HES (HS) - 9400 Series
- b. HES (HS) - 9500/9600 Series.

2.9 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.



2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
  3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
  4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
  5. Electromechanical Options: Subject to same compliance standards and requirements as mechanical exit devices, electrified devices to be of type and design as specified in hardware sets. Include any specific controllers when conventional power supplies are not sufficient to provide the proper inrush current.
  6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
    - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
    - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
  7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
  8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
  9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
  10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
  11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.
1. Acceptable Manufacturers:
    - a. Detex (DE) - Advantex Series
    - b. Sargent Manufacturing (SA) - 80 Series.
    - c. Stanley Precision (PR) - Apex 2000 Series.
    - d. Von Duprin (VD) - 35A/98 XP Series.

## 2.10 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
  2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
  3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
  4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.
  5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
  6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
  7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. Door Closers, Surface Mounted (Large Body Cast Iron): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control.
1. Acceptable Manufacturers:
    - a. LCN Closers (LC) - 4040XP Series.
    - b. Norton Door Controls (NO) – 9500 Series.
    - c. Sargent Manufacturing (SA) - 281 Series.

## 2.11 ELECTROHYDRAULIC DOOR OPERATORS

- A. General: Provide low energy operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for compliance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation devices.
1. Fire-Rated Doors: Provide door operators for fire-rated door assemblies that comply with NFPA 80 for fire-rated door components and are listed and labeled by a qualified testing agency.

- B. Standard: Certified ANSI/BHMA A156.19.
- C. Performance Requirements:
  - 1. Opening Force if Power Fails: Not more than 15 lbf required to release a latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door.
  - 2. Entrapment Protection: Not more than 15 lbf required to prevent stopped door from closing or opening.
- D. Configuration: Surface mounted or in-ground as required. Door operators to control single swinging and pair of swinging doors.
- E. Operation: Power opening and spring closing operation capable of meeting ANSI A117.1 accessibility guideline. Provide time delay for door to remain open before initiating closing cycle as required by ANSI/BHMA A156.19. When not in automatic mode, door operator to function as manual door closer with fully adjustable opening and closing forces, with or without electrical power.
- F. Features: Operator units to have full feature adjustments for door opening and closing force and speed, backcheck, motor assist acceleration from 0 to 30 seconds, time delay, vestibule interface delay, obstruction recycle, and hold open time from 0 up to 30 seconds.
- G. Provide outputs and relays on board the operator to allow for coordination of exit device latch retraction, electric strikes, magnetic locks, card readers, safety and motion sensors and specified auxiliary contacts.
- H. Brackets and Reinforcements: Manufacturer's standard, fabricated from aluminum with nonferrous shims for aligning system components.
- I. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. LCN Closers (LC) - 4640 Series.
  - 2. Norton Door Controls (NO) - 6000 Series.
  - 3. Stanley Security Solutions (ST) – D-4990 Series.

## 2.12 ARCHITECTURAL TRIM

- A. Door Protective Trim
  - 1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
  - 2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
  - a. Stainless Steel: 300 grade, .050-inch thick.
5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Acceptable Manufacturers:
  - a. Hiawatha, Inc. (HI).
  - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
  - c. Trimco (TC).

## 2.13 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
  1. Acceptable Manufacturers:
    - a. Hiawatha, Inc. (HI).
    - b. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    - c. Trimco (TC).
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
  1. Acceptable Manufacturers:
    - a. Architectural Builders Hardware (AH).
    - b. Glynn Johnson (GJ).
    - c. Rixson Door Controls (RF).
    - d. Rockwood Products; ASSA ABLOY Architectural Door Accessories (RO).
    - e. Sargent Manufacturing (SA).

## 2.14 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
  - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
  - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Acceptable Manufacturers:
  - 1. National Guard Products (NG).
  - 2. Pemko Products; ASSA ABLOY Architectural Door Accessories (PE).
  - 3. Reese Enterprises, Inc. (RE).

## 2.15 ELECTRONIC ACCESSORIES

- A. Request-to-Exit Motion Sensor: Request-to-Exit Sensors motion detectors specifically designed for detecting exiting through a door from the secure area to a non-secure area. Include built-in timers (up to 60 second adjustable timing), door monitor with sounder alert, internal vertical pointability coverage, 12VDC or 24VDC power and selectable relay trigger with fail safe/fail secure modes.
  - 1. Acceptable Manufacturers:
    - a. Security Door Controls (SD) - MD-31D Series.
    - b. Securitron (SU) - XMS Series.

- B. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

- 1. Acceptable Manufacturers:

- a. Security Door Controls (SD) - DPS Series.
  - b. Securitron (SU) - DPS Series.

## 2.16 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

## 2.17 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

### 3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

- B. Wood Doors: Comply with ANSI/DHI A115-W series.

### 3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
  - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
  - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
  - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
  - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
  - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

### 3.4 FIELD QUALITY CONTROL

- A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

### 3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

### 3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

### 3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

### 3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

- B. Manufacturer's Abbreviations:

- 1. MK - McKinney
- 2. RO - Rockwood
- 3. SA - Sargent
- 4. KA - Kaba Ilco
- 5. HS - HES
- 6. NO - Norton
- 7. PE - Pemko
- 8. SU - Securitron



**Hardware Sets**

**Set: 1.0**

Doors: E-004, E-007, E-211

1 Hardware	Existing Hardware / No work		OT
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**Set: 2.0**

Doors: E-118A, E-211A

2 Push Plate	85	US26D	RO
1 Hardware	Door Fixed in Place / Blank out Lock Prep		OT

**Set: 3.0**

Doors: 103, 104, 110, 115, 116, 117

1 Hardware	Balance of Hardware by Door Supplier		00
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**Set: 4.0**

Doors: E-119

4 Blank Mortise Cylinder	7160 Blank Cylinder	US26D	KA
1 Hardware	Existing Hardware / No work		OT

**Set: 5.0**

Doors: E-213A, E-213B

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Push Plate	70C 4" x 16"	US32D	RO
1 Pull Plate	BF 110 x 70C 4" x 16"	US32D	RO
1 Overhead Stop (surface)	OH1000S	US32D	RO
1 Door Closer (reg arm, pull side)	281 O	EN	SA
1 Kick Plate	K1050 8" x 2" LDW 4BE CSK	US32D	RO

**Set: 6.0**

Doors: 207, 208

3 Hinge (heavy weight)	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Push Plate	70C 4" x 16"	US32D	RO
1 Pull Plate	BF 110 x 70C 4" x 16"	US32D	RO
1 Door Closer (reg arm, pull side)	281 O	EN	SA
1 Kick Plate	K1050 8" x 2" LDW 4BE CSK	US32D	RO
1 Wall Stop	406	US32D	RO

**Set: 7.0**

Doors: 124B

6 Hinge (heavy weight)	T4A3786 NRP 4-1/2" x 4-1/2"	US26D	MK
1 Exit Device (cvr, nightlatch, elec latch retraction)	11 55 56 AD8410 x 106 turn x 862 pull CMK	US32D	SA
1 Exit Device (cvr, exit only, elec latch retraction)	55 56 AD8410 x 862 pull	US32D	SA
1 Door Closer (hd arm w/ stop, push side)	281 CPS	EN	SA
1 Drop Plate	281D	EN	SA
1 Spacer	581-2	EN	SA
1 Door Operator	6070 x 2ea wall plates (#503 / #505 adjust for location)	689	NO
1 Card Reader	Card Reader by Security Contractor		00
1 Release Push Button	PB4L-2 (location per owner)		SU
2 Electric Power Transfer	CEPT-10		SU
2 Door Position Switch	DPS-x-BK		SU
1 Power Supply	Power Supply by Security Contractor		00

**Set: 8.0**

Doors: 004

3 Hinge (heavy weight)	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Mortise Latch (privacy w/ indicator)	49 8265 LNL	US26D	SA
1 Overhead Stop (surface)	OH1000S	US32D	RO
1 Door Closer (reg arm, pull side)	281 O	EN	SA
1 Kick Plate	K1050 8" x 2" LDW 4BE CSK	US32D	RO

**Set: 9.0**

Doors: 105, 206

3 Hinge (heavy weight)	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Mortise Latch (privacy w/ indicator)	49 8265 LNL	US26D	SA
1 Door Closer (reg arm, pull side)	281 O	EN	SA
1 Kick Plate	K1050 8" x 2" LDW 4BE CSK	US32D	RO
1 Wall Stop	406	US32D	RO

**Set: 10.0**

Doors: E-118

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Cylindrical Lock (office)	11 28 10G05 LL CMK	US26D	SA
1 Wall Stop	409	US32D	RO

**Set: 11.0**

Doors: 202, 203

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Cylindrical Lock (classroom)	11 28 10G37 LL CMK	US26D	SA
1 Wall Stop	406	US32D	RO

**Set: 12.0**

Doors: 201

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Cylindrical Lock (classroom)	11 28 10G37 LL CMK	US26D	SA
1 Overhead Stop (concealed)	OH100S	US32D	RO

**Set: 13.0**

Doors: 006

3 Hinge (heavy weight)	T4A3786 NRP 4-1/2" x 4-1/2"	US26D	MK
1 Cylindrical Lock (storeroom)	11 28 10G04 LL CMK	US26D	SA
1 Electric Strike (fail secure)	4500C	630	HS
1 Door Closer (hd arm, push side)	281 P10	EN	SA
1 Kick Plate	K1050 8" x 2" LDW 4BE CSK	US32D	RO
1 Gasketing	S88D (head and jambs)		PE
1 Wall Stop	406	US32D	RO
1 Card Reader	Card Reader by Security Contractor		00
1 Door Position Switch	DPS-x-BK		SU
1 Motion Sensor	XMS		SU
1 Power Supply	Power Supply by Security Contractor		00

**Set: 14.0**

Doors: 001

3 Hinge (heavy weight)	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Cylindrical Lock (storeroom)	11 28 10G04 LL CMK	US26D	SA
1 Electric Strike (fail secure)	4500C	630	HS
1 Overhead Stop (concealed)	OH100S	US32D	RO
1 Door Closer (reg arm, pull side)	281 O	EN	SA
1 Threshold	171A x MSES10SS		PE
1 Sweep w/ drip	345CNB x TKSP8		PE
1 Weatherstripping	303AS x TKSP8 (head and jamb)		PE
1 Card Reader	Card Reader by Security Contractor		00
1 Door Position Switch	DPS-x-BK		SU
1 Motion Sensor	XMS		SU
1 Power Supply	Power Supply by Security Contractor		00

**Set: 15.0**

Doors: 003

3 Hinge (heavy weight)	T4A3386 NRP 4-1/2" x 4-1/2"	US32D	MK
1 Cylindrical Lock (storeroom)	11 28 10G04 LL CMK	US26D	SA
1 Door Closer (hd arm w/ stop, push side)	281 CPS	EN	SA
1 Threshold	171A x MSES10SS		PE
1 Sweep w/ drip	345CNB x TKSP8		PE
1 Weatherstripping	303AS x TKSP8 (head and jamb)		PE
1 Rain Guard	346A x TKSP8 (door width + 4")		PE
1 Card Reader	Card Reader by Security Contractor		00
1 Door Position Switch	DPS-x-BK		SU
1 Motion Sensor	XMS		SU
1 Latch Protector	321	US32D	RO

**Set: 16.0**

Doors: SW-01

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Cylindrical Lock (classroom)	11 28 10G37 LL CMK	US26D	SA
1 Door Closer (reg arm, pull side)	281 O	EN	SA
1 Kick Plate	K1050 8" x 2" LDW 4BE CSK	US32D	RO
1 Door Stop & Holder	494	US26D	RO

**Set: 17.0**

Doors: 213

3 Hinge (heavy weight)	T4A3786 4-1/2" x 4-1/2"	US26D	MK
1 Cylindrical Lock (classroom)	11 28 10G37 LL CMK	US26D	SA
1 Door Closer (reg arm, pull side)	281 O	EN	SA
1 Kick Plate	K1050 8" x 2" LDW 4BE CSK	US32D	RO
1 Door Stop & Holder	494	US26D	RO

**Set: 18.0**

Doors: 214

6 Hinge (heavy weight)	T4A3786 NRP 4-1/2" x 4-1/2"	US26D	MK
2 Manual Flush Bolt	555	US26D	RO
1 Dust Proof Strike	570	US26D	RO
1 Cylindrical Lock (classroom)	11 28 10G37 LL CMK	US26D	SA
1 Overhead Holder (surface)	OH900H	US32D	RO
1 Door Closer (hd arm w/ stop - holder, push side)	281 CPSH	EN	SA
2 Kick Plate	K1050 8" x 1" LDW 4BE CSK	US32D	RO

**Set: 19.0**

Doors: 107

2 Hinge (spring)	1502 4-1/2" x 4-1/2"	US26D	MK
1 Cylindrical Lock (classroom)	11 28 10G37 LL CMK	US26D	SA
1 Kick Plate	K1050 8" x 2" LDW 4BE CSK	US32D	RO
1 Wall Stop	406	US32D	RO

**Set: 20.0**

Doors: 215

3 Hinge	TA2714 NRP 4-1/2" x 4-1/2"	US26D	MK
1 Cylindrical Lock (storeroom)	11 28 10G04 LL CMK	US26D	SA
1 Kick Plate	K1050 8" x 2" LDW 4BE CSK	US32D	RO
1 Wall Stop	406	US32D	RO

**Set: 21.0**

Doors: M102

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Cylindrical Lock (storeroom)	11 28 10G04 LL CMK	US26D	SA
1 Door Closer (reg arm, pull side)	281 O	EN	SA
1 Kick Plate	K1050 8" x 2" LDW 4BE CSK	US32D	RO
1 Gasketing	S88D (head and jambs)		PE
1 Wall Stop	406	US32D	RO

**Set: 22.0**

Doors: 007

3 Hinge	TA2714 NRP 4-1/2" x 4-1/2"	US26D	MK
1 Cylindrical Lock (storeroom)	11 28 10G04 LL CMK	US26D	SA
1 Door Closer (hd arm w/ stop, push side)	281 CPS	EN	SA
1 Kick Plate	K1050 8" x 2" LDW 4BE CSK	US32D	RO
1 Gasketing	S88D (head and jambs)		PE

**Set: 23.0**

Doors: M101, S2-7

3 Hinge	TA2714 NRP 4-1/2" x 4-1/2"	US26D	MK
1 Cylindrical Lock (storeroom)	11 28 10G04 LL CMK	US26D	SA
1 Door Closer (hd arm, push side)	281 P10	EN	SA
1 Kick Plate	K1050 8" x 2" LDW 4BE CSK	US32D	RO
1 Gasketing	S88D (head and jambs)		PE
1 Wall Stop	406	US32D	RO

**Set: 24.0**

Doors: 005

3 Hinge	TA2714 NRP 4-1/2" x 4-1/2"	US26D	MK
1 Exit Device (fire, rim, classroom)	11 12 8813 x ETL lever CMK	US32D	SA
1 Door Closer (hd arm w/ stop, push side)	281 CPS	EN	SA
1 Kick Plate	K1050 8" x 2" LDW 4BE CSK	US32D	RO
1 Gasketing	S88D (head and jambs)		PE

**Set: 25.0**

Doors: 002

6 Hinge	TA2714 NRP 4-1/2" x 4-1/2"	US26D	MK
2 Manual Flush Bolt	555	US26D	RO
1 Dust Proof Strike	570	US26D	RO
1 Cylindrical Lock (storeroom)	11 28 10G04 LL CMK	US26D	SA
2 Overhead Stop (surface)	OH1000S	US32D	RO
2 Kick Plate	K1050 8" x 1" LDW 4BE CSK	US32D	RO
1 Astragal	Astragal by Door Supplier		00

**Set: 26.0**

Doors: S2-2A, S2-3

3 Hinge	TA2714 NRP 4-1/2" x 4-1/2"	US26D	MK
1 Cylindrical Lock (storeroom)	11 28 10G04 LL CMK	US26D	SA
1 Door Closer (reg arm, pull side)	281 O	EN	SA
1 Wall Stop	406	US32D	RO
1 Threshold	171A x MSES10SS		PE
1 Sweep w/ drip	345CNB x TKSP8		PE
1 Weatherstripping	303AS x TKSP8 (head and jamb)		PE
1 Door Position Switch	DPS-x-BK		SU

**Set: 27.0**

Doors: S1-1, S1-2, S2-1, S2-2

3 Hinge (heavy weight)	T4A3786 NRP 4-1/2" x 4-1/2"	US26D	MK
1 Exit Device (fire, rim, classroom)	11 12 8813 x ETL lever CMK	US32D	SA
1 Door Closer (hd arm, push side)	281 P10	EN	SA
1 Kick Plate	K1050 8" x 2" LDW 4BE CSK	US32D	RO
1 Gasketing	S88D (head and jambs)		PE
1 Wall Stop	406	US32D	RO

**Set: 28.0**

Doors: 119

4 Hinge (heavy weight)	T4A3386 NRP 4-1/2" x 4-1/2"	US32D	MK
1 Exit Device (rim, exit only)	8810	US32D	SA
1 Door Closer (hd arm w/ stop, push side)	281 CPS	EN	SA
1 Drop Plate	281D	EN	SA
1 Spacer	581-2	EN	SA
1 Threshold	171A x MSES10SS		PE
1 Sweep w/ drip	345CNB x TKSP8		PE
1 Weatherstripping	Weatherstripping by Door and Frame Supplier		00
1 Door Position Switch	DPS-x-BK		SU
1 Motion Sensor	XMS		SU



**Set: 29.0**

Doors: SW-00

3 Hinge (heavy weight)	T4A3386 NRP 4-1/2" x 4-1/2"	US32D	MK
1 Exit Device (fire, rim, classroom)	11 12 8813 x ETL lever CMK	US32D	SA
1 Door Closer (hd arm w/ stop, push side)	281 CPS	EN	SA
1 Kick Plate	K1050 8" x 2" LDW 4BE CSK	US32D	RO
1 Threshold	171A x MSES10SS		PE
1 Sweep w/ drip	345CNB x TKSP8		PE
1 Weatherstripping	303AS x TKSP8 (head and jamb)		PE
1 Rain Guard	346A x TKSP8 (door width + 4")		PE
1 Door Position Switch	DPS-x-BK		SU
1 Motion Sensor	XMS		SU

**Set: 30.0**

Doors: 204, 210

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Cylindrical Lock (storeroom)	11 28 10G04 LL CMK	US26D	SA
1 Electric Strike (fail secure)	4500C	630	HS
1 Door Closer (reg arm, pull side)	281 O	EN	SA
1 Kick Plate	K1050 8" x 2" LDW 4BE CSK	US32D	RO
1 Wall Stop	406	US32D	RO
1 Card Reader	Card Reader by Security Contractor		00
1 Door Position Switch	DPS-x-BK		SU
1 Motion Sensor	XMS		SU
1 Power Supply	Power Supply by Security Contractor		00

**Set: 31.0**

Doors: S2-1.5

3 Hinge (heavy weight)	T4A3786 NRP 4-1/2" x 4-1/2"	US26D	MK
1 Cylindrical Lock (classroom)	11 28 10G37 LL CMK	US26D	SA
1 Door Closer (hd arm, push side)	281 P10	EN	SA
1 Kick Plate	K1050 8" x 2" LDW 4BE CSK	US32D	RO
1 Gasketing	S88D (head and jambs)		PE
1 Wall Stop	406	US32D	RO

**Set: 32.0**

Doors: 108

3 Hinge (heavy weight)	T4A3786 NRP 4-1/2" x 4-1/2"	US26D	MK
1 Cylindrical Lock (storeroom)	11 28 10G04 LL CMK	US26D	SA
1 Door Closer (hd arm, push side)	281 P10	EN	SA
1 Kick Plate	K1050 8" x 2" LDW 4BE CSK	US32D	RO
1 Wall Stop	406	US32D	RO

**Set: 33.0**

Doors: S1-0, S2.0

3 Hinge (heavy weight)	T4A3386 NRP 4-1/2" x 4-1/2"	US32D	MK
1 Exit Device (fire, rim, nightlatch)	11 12 8804 FSW	US20D	SA
1 Electric Strike (fail secure)	9500	630	HS
1 Door Closer (hd arm w/ stop, push side)	281 CPS	EN	SA
1 Kick Plate	K1050 8" x 2" LDW 4BE CSK	US32D	RO
1 Threshold	171A x MSES10SS		PE
1 Sweep w/ drip	345CNB x TKSP8		PE
1 Weatherstripping	303AS x TKSP8 (head and jamb)		PE
1 Rain Guard	346A x TKSP8 (door width + 4")		PE
1 Card Reader	Card Reader by Security Contractor		00
1 Door Position Switch	DPS-x-BK		SU
1 Motion Sensor	XMS		SU
1 Power Supply	Power Supply by Security Contractor		00

**Set: 34.0**

Doors: S1

3 Hinge (heavy weight)	T4A3786 NRP 4-1/2" x 4-1/2"	US26D	MK
1 Exit Device (fire, rim, nightlatch)	11 12 8804 FSW	US20D	SA
1 Electric Strike (fail secure)	9500	630	HS
1 Door Closer (hd arm, push side)	281 P10	EN	SA
1 Kick Plate	K1050 8" x 2" LDW 4BE CSK	US32D	RO
1 Gasketing	S88D (head and jambs)		PE
1 Wall Stop	406	US32D	RO
1 Card Reader	Card Reader by Security Contractor		00
1 Door Position Switch	DPS-x-BK		SU
1 Motion Sensor	XMS		SU
1 Power Supply	Power Supply by Security Contractor		00

**Set: 35.0**

## Doors: 124A

6 Hinge (heavy weight)	T4A3386 NRP 4-1/2" x 4-1/2"	US32D	MK
1 Exit Device (cvr, nightlatch, elec latch retraction)	11 55 56 AD8410 x 106 turn x 862 pull CMK	US32D	SA
1 Exit Device (cvr, exit only, elec latch retraction)	55 56 AD8410 x 862 pull	US32D	SA
1 Door Closer (hd arm w/ stop, push side)	281 CPS	EN	SA
1 Drop Plate	281D	EN	SA
1 Spacer	581-2	EN	SA
1 Door Operator	6070 x 2ea wall plates (#503 / #505 adjust for location)	689	NO
1 Threshold	171A x MSES10SS		PE
2 Sweep w/ drip	345CNB x TKSP8		PE
1 Weatherstripping	Weatherstripping by Door and Frame Supplier		00
1 Card Reader	Card Reader by Security Contractor		00
2 Electric Power Transfer	CEPT-10		SU
2 Door Position Switch	DPS-x-BK		SU
1 Power Supply	Power Supply by Security Contractor		00

END OF SECTION 08 7100

## SECTION 08 8000 - GLAZING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes:
  - 1. Glass for windows doors storefront framing glazed curtain walls.
  - 2. Glazing sealants and accessories.
- B. Related Requirements:
  - 1. Section 08 8813 "Fire-Resistant Glazing."

#### 1.3 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

#### 1.4 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
  - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 2. Review temporary protection requirements for glazing during and after installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of the following products; 12 inches square.
  - 1. Insulating glass.
- C. 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.

1.6 QUALITY ASSURANCE

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

1.7 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.

1.8 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.

1.9 WARRANTY

- A. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in glass schedules or comparable product by one of the following:
  - 1. Cardinal Glass Industries.
  - 2. Guardian Industries Corp.; SunGuard.
  - 3. PPG Industries, Inc.
  - 4. Viracon, Inc.
- B. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

### 2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300.
  - 1. Design Wind Pressures: As indicated on Drawings.
  - 2. Design Wind Pressures: Determine design wind pressures applicable to Project according to ASCE/SEI 7, based on heights above grade indicated on Drawings.
    - a. Wind Design Data: As indicated on Drawings.
  - 3. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
  - 4. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
- D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
  - 1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.

2. For laminated-glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. 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.
5. 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.
6. Visible Reflectance: Center-of-glazing values, according to NFRC 300.

## 2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
  1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
  2. IGM Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC 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.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of IGCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum.
  1. Minimum Glass Thickness for Exterior Lites: 6 mm.
- E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass. Where fully tempered float glass is indicated, provide fully tempered float glass.

## 2.4 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.
- B. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
  1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

## 2.5 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190.
  - 1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
  - 2. Perimeter Spacer: Manufacturer's standard spacer material and construction .
  - 3. Desiccant: Molecular sieve or silica gel, or a blend of both.

## 2.6 GLAZING SEALANTS

- A. General:
  - 1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
  - 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
  - 3. Colors of Exposed Glazing Sealants: 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.

## 2.7 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
  - 1. AAMA 804.3 tape, where indicated.
  - 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
  - 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

## 2.8 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.



- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

## 2.9 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
  - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
    - a. Temperature Change: 120 deg F, 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.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
  - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
  - 2. Presence and functioning of weep systems.
  - 3. Minimum required face and edge clearances.
  - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

### 3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
  - 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.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

### 3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

### 3.5 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.

### 3.6 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.

- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
  - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

### 3.7 MONOLITHIC GLASS SCHEDULE

- A. Glass Type:(CG)Clear annealed float glass.
  - 1. Minimum Thickness: 6 mm.
- B. Glass Type(CTG) Clearfully tempered float glass.
  - 1. Minimum Thickness: 6 mm.
  - 2. Safety glazing required.

### 3.8 INSULATING GLASS SCHEDULE

- A. Glass Type:(CIG) Low-E-coated, clear insulating glass.
  - 1. Basis-of-Design Product: PPG Solarban 60.
  - 2. Overall Unit Thickness: 1 inch.
  - 3. Minimum Thickness of Each Glass Lite: 6 mm.
  - 4. Outdoor Lite: Fully tempered float glass.
  - 5. Interspace Content: Argon.
  - 6. Indoor Lite: Fully tempered float glass.
  - 7. Low-E Coating: Sputtered on second surface.
  - 8. Winter Nighttime U-Factor: 0.24 maximum.
  - 9. Visible Light Transmittance: 70 percent minimum.
  - 10. Solar Heat Gain Coefficient: 0.39 maximum.
  - 11. Safety glazing required.
- B. Glass Type:(CTIG) Low-E coated, clear insulating glass.
  - 1. Basis-of-Design Product: PPG Solarban 60.
  - 2. Overall Unit Thickness: 1 inch.
  - 3. Minimum Thickness of Each Glass Lite: 6 mm.
  - 4. Outdoor Lite: Fully tempered float glass.

5. Interspace Content: Argon.
6. Indoor Lite: Fully tempered float glass.
7. Low-E Coating: Sputtered on second surface.
8. Winter Nighttime U-Factor: 0.24 maximum.
9. Visible Light Transmittance: 70 percent minimum.
10. Solar Heat Gain Coefficient: 0.39 maximum.
11. Safety glazing required.

END OF SECTION 08 8000

## SECTION 08 8813 - FIRE-RESISTANT GLAZING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Fire-protection-rated glazing.

#### 1.3 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

#### 1.4 COORDINATION

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

#### 1.5 ACTION SUBMITTALS

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

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Sample Warranties: For special warranties.

#### 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: 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.

1.10 WARRANTY

- A. Manufacturer's Special Warranty on Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

- 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
- 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 impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; deterioration of glazing materials; or other defects in construction.

## 2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organization below unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
  - 1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
- B. Safety Glazing Labeling: Permanently mark glazing with certification label of the Safety Glazing Certification Council. Label shall indicate manufacturer's name, type of glass, glass thickness, and safety glazing standard with which glass complies.

## 2.4 GLASS PRODUCTS

- A. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
  - 1. Construction: Laminate glass with polyvinyl butyral interlayer unless fire-protection or fire-resistance rating is based on another product.
  - 2. Interlayer Thickness: Provide thickness as needed to comply with requirements.
  - 3. Interlayer Color: Clear unless otherwise indicated.

## 2.5 FIRE-PROTECTION-RATED GLAZING

- A. Fire-Protection-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing according to NFPA 257 or UL 9, including the hose-stream test, and shall comply with NFPA 80.
  - 1. Fire-protection-rated glazing required to have a fire-protection rating of 20 minutes shall be exempt from the hose-stream test.
- B. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name; test standard; whether glazing is permitted to be used in doors or openings; if permitted in openings, whether or not glazing has passed the hose-stream test; whether or not glazing meets 450 deg F (250 deg C) temperature-rise limitation; and the fire-resistance rating in minutes.



- C. Glass Type (FRG) Laminated Glass with Intumescent Interlayers: Laminated glass made from multiple plies of uncoated, ultraclear float glass; with intumescent interlayers; and complying with 16 CFR 1201, Category II.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. InterEdge Technologies by AGC Flat Glass; Pyrobel.
    - b. Pilkington North America; Pyrostop.
    - c. Technical Glass Products; Pyrostop.
    - d. Vetrotech Saint-Gobain; Contraflam.

## 2.6 GLAZING ACCESSORIES

- A. 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. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Dow Corning Corporation; 795.
    - b. GE Construction Sealants; Momentive Performance Materials Inc; SilGlaze II SCS2800.
    - c. Tremco Incorporated; Spectrem 2.
  2. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- 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 804.3 tape, where indicated.
  2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
  3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

## 2.7 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

- B. 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.
- C. Perimeter Insulation for Fire-Resistive Glazing: Product that is approved by testing agency that listed and labeled fire-resistant glazing product with which it is used for application and fire-protection rating indicated.

## 2.8 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.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with manufacturing and installation tolerances, including those for size, squareness, and offsets at corners, and for compliance with minimum required face and edge clearances.
- 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 fire side and protected side. Label or mark units as needed so that fire side and protected side are readily identifiable. Do not use materials that leave visible marks in the completed work.

### 3.3 GLAZING, GENERAL

- A. Use methods approved by testing agencies that listed and labeled fire-resistant glazing products.
- B. 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.

- 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 is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and 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 with proper orientation so that coatings face fire side or protected side as specified.

### 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 and then to jambs. Cover horizontal framing joints by applying tapes to jambs and 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. 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.

### 3.5 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. 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 washaway from glass.

### 3.6 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
  - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces in each area of Project 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.

END OF SECTION 08 8813

## SECTION 09 2216 - NON-STRUCTURAL METAL FRAMING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Non-load-bearing steel framing systems for interior partitions.
  - 2. Suspension systems for interior ceilings and soffits.
  - 3. Grid suspension systems for gypsum board ceilings.

#### 1.3 ACTION SUBMITTALS

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

### PART 2 - PRODUCTS

#### 2.1 FRAMING SYSTEMS

- A. Studs and Tracks: ASTM C 645.
  - 1. Steel Studs and Tracks:
    - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) CEMCO; California Expanded Metal Products Co.
      - 2) MBA Building Supplies.
      - 3) MRI Steel Framing, LLC.
      - 4) Phillips Manufacturing Co.
      - 5) Steel Network, Inc. (The).
      - 6) Telling Industries.
    - b. Minimum Base-Metal Thickness: 15 Mil for walls, 30 Mil for jambs, walls supporting millwork, headers, and window frame assemblies. As indicated on Drawings.
    - c. Depth: As indicated on Drawings.

- B. Slip-Type Head Joints: Where indicated, provide one of the following:
1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to tracks while allowing 2-inch minimum vertical movement.
    - 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) CEMCO; California Expanded Metal Products Co.; Deflex Clips.
      - 2) ClarkDietrich Building Systems; FTC3.
      - 3) Fire Trak Corp; PosiKlip.
      - 4) Steel Network, Inc. (The); VertiClip SLD Series.
      - 5) Super Stud Building Products Inc.; Deflection Clips.
  2. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
    - a. Products: available products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) BlazeFrame Industries; Bare Slotted Track (BST/BST 2).
      - 2) CEMCO; California Expanded Metal Products Co.; CST Slotted Deflection Track.
      - 3) ClarkDietrich Building Systems; SLP-TRK Slotted Deflection Track.
      - 4) MBA Building Supplies; FlatSteel Deflection Track.
      - 5) Metal-Lite; The System.
      - 6) Steel Network, Inc. (The); VertiClip SLD.
      - 7) Telling Industries; Vertical Slip Track.
- C. Firestop Tracks: Top track manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. BlazeFrame Industries; Intumescent Framing, Fire Stop System.
    - b. CEMCO; California Expanded Metal Products Co.; FAS Track.
    - c. ClarkDietrich Building Systems; BlazeFrame.
    - d. Fire Trak Corp; Fire Trak System attached to studs with Fire Trak Posi Klip.
    - e. Metal-Lite; The System.
    - f. Perfect Wall, Inc.
    - g. Steel Network, Inc. (The).

- D. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. ClarkDietrich Building Systems.
    - b. MRI Steel Framing, LLC.
- E. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
  - 1. Configuration: Asymmetrical.
- F. Z-Shaped Furring: 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.

## 2.2 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
- B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- C. Furring Channels (Furring Members):
  - 1. Resilient Furring Channels: 1/2-inch- deep members designed to reduce sound transmission.
    - a. Configuration: Asymmetrical.
- D. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Armstrong World Industries, Inc; Drywall Grid Systems.
    - b. Chicago Metallic Corporation; 640/660 Drywall Ceiling Suspension .
    - c. United States Gypsum Company; Drywall Suspension System.

## 2.3 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
  - 1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

- B. Isolation Strip at Exterior Walls: Provide the following:
  - 1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
  - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
- B. Coordination with Sprayed Fire-Resistive Materials:
  - 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling 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 Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
  - 2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
  - 3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.



4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

### 3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
  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. Install studs so flanges within framing system point in same direction.
- D. Install tracks 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. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
    - a. Install two studs at each jamb unless otherwise indicated.
    - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch 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.
  2. 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.
  3. 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.

4. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
5. Curved Partitions:
  - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
  - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.
- E. 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.
- F. Z-Shaped Furring Members:
  1. Erect insulation, specified in Section 07 2100 "Thermal Insulation," vertically and hold in place with Z-shaped furring members spaced 24 inches o.c.
- G. 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.

### 3.5 INSTALLING CEILING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
  1. Hangers: 48 inches o.c.
  2. Carrying Channels (Main Runners): 48 inches o.c.
  3. Furring Channels (Furring Members): 24 inches o.c.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
  1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
    - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
    - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.

3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  5. Do not attach hangers to steel roof deck.
  6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
  7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
  8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

END OF SECTION 09 2216

## SECTION 09 2900 - GYPSUM BOARD

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Interior gypsum board.
  - 2. Exterior gypsum board for ceilings and soffits.
  - 3. Tile backing panels.
- B. Related Requirements:
  - 1. Section 06 1600 "Sheathing" for gypsum sheathing for exterior walls.
  - 2. Section 09 2216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

#### 1.3 ACTION SUBMITTALS

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

#### 1.4 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.

#### 1.5 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 plotchy surface contamination and discoloration.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- C. Ceiling and wall materials shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

### 2.2 INTERIOR GYPSUM BOARD

- A. Gypsum Wallboard: ASTM C 1396/C 1396M.
- B. Gypsum Board, Type X: ASTM C 1396/C 1396M.
  1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. American Gypsum.
    - b. CertainTeed Corporation.
    - c. Continental Building Products, LLC.
    - d. Georgia-Pacific Building Products.
    - e. National Gypsum Company.
    - f. PABCO Gypsum.
    - g. Temple-Inland Building Products by Georgia-Pacific.
    - h. USG Corporation.
  2. Thickness: 5/8 inch.
  3. Long Edges: Tapered.
- C. Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
  1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. American Gypsum.

- b. CertainTeed Corporation.
  - c. Continental Building Products, LLC.
  - d. Georgia-Pacific Building Products.
  - e. National Gypsum Company.
  - f. PABCO Gypsum.
  - g. Temple-Inland Building Products by Georgia-Pacific.
  - h. USG Corporation.
- 2. Core: 5/8 inch, Type X.
  - 3. Long Edges: Tapered.
  - 4. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

## 2.3 TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Board: ASTM C 1178/C 1178M, with manufacturer's standard edges.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. CertainTeed Corporation.
    - b. Georgia-Pacific Building Products.
    - c. National Gypsum Company.
    - d. Temple-Inland Building Products by Georgia-Pacific.
    - e. USG Corporation.
  - 2. Core: 5/8 inch, Type X.
  - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- B. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or ASTM C 1325, with manufacturer's standard edges.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. C-Cure.
    - b. CertainTeed Corporation.
    - c. Custom Building Products.
    - d. FinPan, Inc.
    - e. James Hardie Building Products, Inc.
    - f. National Gypsum Company.
    - g. USG Corporation.
  - 2. Thickness: 5/8 inch.
  - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

## 2.4 TRIM ACCESSORIES

### A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:
  - a. Cornerbead.
  - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
  - c. L-Bead: L-shaped; exposed long flange receives joint compound.
  - d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
  - e. Expansion (control) joint.
  - f. Curved-Edge Cornerbead: With notched or flexible flanges.

## 2.5 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.

### 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 setting-type taping compound.
  - a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.

## 2.6 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.

### 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. Sound-Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
  - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- E. Acoustical Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Accumetric LLC.
    - b. Franklin International.
    - c. Grabber Construction Products.
    - d. Hilti, Inc.
    - e. Pecora Corporation.
    - f. Specified Technologies, Inc.
    - g. USG Corporation.
- F. Thermal Insulation: As specified in Section 07 2100 "Thermal Insulation."

### 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.
- 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. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.
- J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

### 3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
1. Wallboard Type: As indicated on Drawings.
  2. Type X: Vertical surfaces unless otherwise indicated.
  3. Mold-Resistant Type: In wet areas.
  4. Type C: Where required for specific fire-resistance-rated assembly indicated.
- B. Single-Layer Application:
1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
  2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    - 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 with screws; fasten face layers with adhesive and supplementary fasteners.
- D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

E. Curved Surfaces:

1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch- long straight sections at ends of curves and tangent to them.
2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.4 APPLYING TILE BACKING PANELS

- A. Glass-Mat, Water-Resistant Backing Panels: Comply with manufacturer's written installation instructions and install at [showers, tubs, and where indicated] [locations indicated to receive tile]. Install with 1/4-inch gap where panels abut other construction or penetrations.
- B. Cementitious Backer Units: ANSI A108.11, at locations indicated to receive tile.
- C. 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 at locations indicated on Drawings according to ASTM C 840 and in specific locations approved by Architect for visual effect.
- C. Interior Trim: Install in the following locations:
  1. Cornerbead: Use at outside corners unless otherwise indicated.
  2. LC-Bead: Use at exposed panel edges.
  3. L-Bead: Use where indicated.
  4. U-Bead: Use at exposed panel edges.

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 2: Panels that are substrate for tile.
  3. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
    - a. Primer and its application to surfaces are specified in Section 09 9123 "Interior Painting."
    - b. Primer and its application to surfaces are specified in Section 09 9123 "Interior Painting."
- E. Glass-Mat Faced Panels: 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 09 2900

## SECTION 09 3013 - CERAMIC TILING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Porcelain floor tile.
  - 2. Ceramic wall tile.
  - 3. Crack isolation membrane.
  - 4. Metal edge strips.
- B. Related Requirements:
  - 1. Section 07 9200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

#### 1.3 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."
- C. Module Size: Actual tile size plus joint width indicated.
- D. Face Size: Actual tile size, excluding spacer lugs.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. 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.

#### 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
  2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications:

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

#### 1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Source Limitations for Tile: Obtain tile of each color or finish from single source or producer.
  1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.

- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
  - 1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
  - 1. Crack isolation membrane.
  - 2. Metal edge strips.

## 2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
  - 1. Provide tile complying with Standard grade requirements unless otherwise indicated.
- 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. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.

## 2.3 TILE PRODUCTS

- A. Ceramic Wall Tile and Porcelain Floor Tile Basis-of-Design Products as listed in the Finish Schedule. .

## 2.4 THRESHOLDS

- A. General: Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
  - 1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.

## 2.5 CRACK ISOLATION MEMBRANE

- A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

## 2.6 SETTING MATERIALS

- A. Modified Dry-Set Mortar (Thinset): ANSI A118.4.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. ARDEX Americas.
    - b. Boiardi Products Corporation; a QEP company.
    - c. Bonsal American, an Oldcastle company.
    - d. Bostik, Inc.
    - e. LATICRETE SUPERCAP, LLC.
    - f. MAPEI Corporation.
    - g. Summitville Tiles, Inc.
    - h. TEC / H.B. Fuller Construction Products Inc.
  - 2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
  - 3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.
- B. Improved Modified Dry-Set Mortar (Thinset): ANSI A118.15.
  - 1. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.15.
- C. EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar (Thinset): ANSI A118.11.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. ARDEX Americas.
    - b. Bonsal American, an Oldcastle company.
    - c. Bostik, Inc.
    - d. LATICRETE SUPERCAP, LLC.
    - e. MAPEI Corporation.
    - f. Summitville Tiles, Inc.
    - g. TEC / H.B. Fuller Construction Products Inc.



## 2.7 GROUT MATERIALS

- A. Sand-Portland Cement Grout: ANSI A108.10, consisting of white or gray cement and white or colored aggregate as required to produce color indicated.
- B. Water-Cleanable Epoxy Grout: ANSI A118.3[, with a VOC content of 65 g/L or less].
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Bonsal American, an Oldcastle company.
    - b. Bostik, Inc.
    - c. LATICRETE SUPERCAP, LLC.
    - d. MAPEI Corporation.
    - e. TEC / H.B. Fuller Construction Products Inc.
  - 2. 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.

## 2.8 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. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; stainless-steel, ASTM A 666, 300 Series exposed-edge material.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Blanke Corporation.
    - b. Ceramic Tool Company, Inc.
    - c. Schluter Systems L.P.
- C. 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.
- D. Floor Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Bonsal American, an Oldcastle company.
    - b. Custom Building Products.

- c. Jamo Inc.
- d. Southern Grouts & Mortars, Inc.
- e. Summitville Tiles, Inc.

## 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.
  - 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 adhesives or thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.

- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.
- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

### 3.3 CERAMIC TILE INSTALLATION

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
  - 1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
    - a. Tile floors in wet areas.
    - b. Tile floors consisting of tiles 8 by 8 inches or larger.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.
- F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
  - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
  - 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
  - 3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

- G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
  - 1. Ceramic Wall Tile: 1/16 inch.
  - 2. Porcelain floor Tile: 1/4 inch.
- H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- I. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
  - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- J. Metal Edge Strips: Install where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.
- K. Floor Sealer: Apply floor sealer to[ cementitious] grout joints[ in tile floors] according to floor-sealer manufacturer's written instructions. As soon as floor sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

#### 3.4 CRACK ISOLATION MEMBRANE INSTALLATION

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
- B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

#### 3.5 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.

3.6 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION 09 3013

## SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes acoustical panels and exposed suspension systems for interior ceilings.

#### 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, 6 inches in size.
- C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:
  - 1. Acoustical Panels: Set of 6-inch- square Samples of each type, color, pattern, and texture.
  - 2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- long Samples of each type, finish, and color.

#### 1.4 CLOSEOUT SUBMITTALS

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

#### 1.5 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. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
  - 2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.
  - 3. Hold-Down Clips: Equal to 2 percent of quantity installed.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site 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.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system 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: Class A according to ASTM E 1264.
  - 2. Smoke-Developed Index: 50 or less.
- B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Indicate design designations from UL or from the listings of another qualified testing agency.

2.3 ACOUSTICAL PANELS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. American Gypsum.
  - 2. Armstrong World Industries, Inc.
  - 3. CertainTeed Corporation.

4. Chicago Metallic Corporation.
5. Tectum Inc.
6. United States Gypsum Company.

- B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

## 2.4 METAL SUSPENSION SYSTEM

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Armstrong World Industries, Inc.
  2. CertainTeed Corporation.
  3. Chicago Metallic Corporation.
  4. United States Gypsum Company.
- B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M and designated by type, structural classification, and finish indicated.

## 2.5 ACCESSORIES

- A. Wire Hangers, Braces, and Ties: Provide wires as follows:
1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
  2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch- diameter wire.
- B. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- C. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.
- D. Hold-Down Clips: Manufacturer's standard hold-down.

## 2.6 METAL EDGE MOLDINGS AND TRIM

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Armstrong World Industries, Inc.
  2. CertainTeed Corporation.
  3. Chicago Metallic Corporation.
  4. Fry Reglet Corporation.
  5. Gordon, Inc.



6. United States Gypsum Company.

- B. 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.

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 unless otherwise indicated, and comply with layout shown on reflected ceiling plans.
- B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

- A. Install acoustical panel ceilings according to ASTM C 636/C 636M and manufacturer's written instructions.
- 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 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. 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.
  5. Do not attach hangers to steel deck tabs.
  6. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  7. 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.
  8. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
  2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
  3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.
1. Arrange directionally patterned acoustical panels as follows:
    - a. As indicated on reflected ceiling plans.
  2. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
  3. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
  4. 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.
  5. Protect lighting fixtures and air ducts according to requirements indicated for fire-resistance-rated assembly.

### 3.4 ERECTION TOLERANCES

- A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.
- B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 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.
- B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 5113

## SECTION 09 6400 - WOOD FLOORING

### 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. Field-finished wood flooring.

#### 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. Wood Flooring: Equal to 1 percent of amount installed for each type, color, and finish of wood flooring indicated.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wood flooring materials in unopened cartons or bundles.
- B. Protect wood flooring from exposure to moisture. Do not deliver wood flooring until after concrete, masonry, plaster, ceramic tile, and similar wet-work is complete and dry.
- C. Store wood flooring materials in a dry, warm, ventilated, weathertight location.

#### 1.5 FIELD CONDITIONS

- A. Conditioning period begins not less than seven days before wood flooring installation, is continuous through installation, and continues not less than seven days after wood flooring installation.
  - 1. Environmental Conditioning: Maintain ambient temperature between 65 and 75 deg F and relative humidity planned for building occupants in spaces to receive wood flooring during the conditioning period.
  - 2. Wood Flooring Conditioning: Move wood flooring into spaces where it will be installed, no later than the beginning of the conditioning period.
    - a. Do not install flooring until it adjusts to relative humidity of, and is at same temperature as, space where it is to be installed.

- b. Open sealed packages to allow wood flooring to acclimatize immediately on moving flooring into spaces in which it will be installed.
- B. After conditioning period, maintain relative humidity and ambient temperature planned for building occupants.
- C. Install factory-finished wood flooring after other finishing operations, including painting, have been completed.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Hardwood Flooring: Comply with NWFA A500 for species, grade, and cut.
  - 1. Certification: Provide flooring that carries NWFA grade stamp on each bundle or piece.
- B. Maple Flooring: Comply with applicable MFMA grading rules for species, grade, and cut.
  - 1. Certification: Provide flooring that carries MFMA mark on each bundle or piece.
- C. Softwood Flooring: Comply with WCLIB No. 17 grading rules for species, grade, and cut.

### 2.2 FIELD-FINISHED WOOD FLOORING

- A. Solid-Wood Flooring: Kiln dried to 6 to 9 percent maximum moisture content; tongue and groove and end matched; with backs channeled.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of wood flooring.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Concrete Slabs:
  - 1. Grind high spots and fill low spots to produce a maximum 1/8-inch deviation in any direction when checked with a 10-foot straight edge.

2. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
  3. Remove coatings, including curing compounds, and other substances on substrates that are incompatible with installation adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- B. Broom or vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.3 INSTALLATION

- A. Comply with flooring manufacturer's written installation instructions, but not less than applicable recommendations in NWFA's "Installation Guidelines."
- B. Provide expansion space at walls and other obstructions and terminations of flooring of not less than 3/4 inch.
- C. Sound Control Underlayment: Install over vapor retarder according to manufacturer's written instructions.
- D. Solid-Wood Flooring: Blind nail or staple flooring to substrate.
1. Plank Flooring: For flooring of face width more than 3 inches:
    - a. Hardwood: Install countersunk screws at each end of each piece in addition to blind nailing. Cover screw heads with wood plugs glued flush with flooring.
    - b. Softwood: Install no fewer than two countersunk nails at each end of each piece, spaced not more than 16 inches along length of each piece, in addition to blind nailing. Fill holes with matching wood filler.

### 3.4 FIELD FINISHING

- A. Machine-sand flooring to remove offsets, ridges, cups, and sanding-machine marks that are noticeable after finishing. Vacuum and tack with a clean cloth immediately before applying finish.
1. Comply with applicable recommendations in NWFA's "Installation Guidelines."
- B. Fill open-grained hardwood.
- C. Fill and repair wood flooring defects.
- D. Apply floor-finish materials in number of coats recommended by finish manufacturer for application indicated, but not less than one coat of floor sealer and three finish coats.
1. Apply stains to achieve an even color distribution matching approved Samples.

2. For water-based finishes, use finishing methods recommended by finish manufacturer to minimize grain raise.

E. Cover wood flooring before finishing.

F. Do not cover wood flooring after finishing until finish reaches full cure, and not before seven days after applying last finish coat.

### 3.5 PROTECTION

A. Protect installed wood flooring during remainder of construction period with covering of heavy kraft paper or other suitable material. Do not use plastic sheet or film that might cause condensation.

1. Do not move heavy and sharp objects directly over kraft-paper-covered wood flooring. Protect flooring with plywood or hardboard panels to prevent damage from storing or moving objects over flooring.

END OF SECTION 09 6400

## SECTION 09 6513 - RESILIENT BASE AND ACCESSORIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Vinyl base.

#### 1.3 ACTION SUBMITTALS

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

#### 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 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following 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.



## PART 2 - PRODUCTS

### 2.1 VINYL BASE

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Armstrong World Industries, Inc.
  - 2. Burke Mercer Flooring Products; a division of Burke Industries Inc.
  - 3. Johnsonite; A Tarkett Company.
  - 4. Roppe Corporation, USA.
  - 5. VPI Corporation.
- B. Product Standard: ASTM F 1861, Type TV (vinyl, thermoplastic).
  - 1. Group: I (solid, homogeneous).
  - 2. Style and Location:
    - a. Style A, Straight: Provide in areas with carpet.
    - b. Style B, Cove: Provide in areas with resilient floor coverings.
- C. Minimum Thickness: 0.125 inch.
- D. Height: 4 inches.
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Job formed.
- G. Inside Corners: Job formed.
- H. Colors and Patterns: As selected by Architect from manufacturers standard colors..

### 2.2 INSTALLATION MATERIALS

- A. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

## 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 materials are the same temperature as space where they are to be installed.
  - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

### 3.3 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 surfaces.
  - 2. Sweep and vacuum horizontal surfaces thoroughly.
  - 3. Damp-mop horizontal surfaces to remove marks and soil.
- C. Protect resilient products from marks, 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 09 6513

## SECTION 09 6516 - RESILIENT SHEET FLOORING

### 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. Unbacked vinyl sheet flooring.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of resilient sheet flooring.
- C. Samples for Verification: For each type of resilient sheet flooring, in manufacturer's standard size, but not less than 6-by-9-inch sections of each color, texture, and pattern required.
  - 1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of resilient sheet flooring to include in maintenance manuals.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient sheet flooring 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 rolls upright.

#### 1.6 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F, in spaces to receive resilient sheet flooring during the following 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. Close spaces to traffic during resilient sheet flooring installation.
- D. Close spaces to traffic for 48 hours after resilient sheet flooring installation.
- E. Install resilient sheet flooring after other finishing operations, including painting, have been completed.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For resilient sheet 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 UNBACKED VINYL SHEET FLOORING

- A. Products: Subject to compliance with requirements, provide the following:
1. Mannington Mills, Inc.; Streamline see Finish Schedule.
- B. Product Standard: ASTM F 1913.
- C. Thickness: 0.080 inch.
- D. Wearing Surface: Smooth.
- E. Sheet Width: 6 feet.
- F. Seamless-Installation Method: Heat welded.

## 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 sheet flooring.

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

### 3.2 PREPARATION

- A. Prepare substrates according to resilient sheet flooring manufacturer's written instructions to ensure adhesion of resilient sheet 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 resilient sheet flooring manufacturer. Do not use solvents.
  - 3. Alkalinity and Adhesion Testing: Perform tests recommended by resilient sheet flooring 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: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
    - a. 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.
    - b. Relative Humidity Test: Using in-situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient sheet flooring until materials are the same temperature as space where they are to be installed.
  - 1. At least 48 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient sheet flooring.

### 3.3 RESILIENT SHEET FLOORING INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient sheet flooring.
- B. Unroll resilient sheet flooring and allow it to stabilize before cutting and fitting.
- C. Lay out resilient 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. Avoid cross seams.
- D. Scribe and cut resilient sheet flooring to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend resilient sheet flooring into toe spaces, door reveals, closets, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on resilient sheet flooring as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Install resilient sheet flooring on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.
- H. Adhere resilient sheet flooring to 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.
- I. Seamless Installation:
1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and heat weld with welding bead to fuse sections permanently into a seamless flooring installation. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.
- J. Integral-Flash-Cove Base: Cove resilient sheet flooring 6 inches up vertical surfaces. Support flooring at horizontal and vertical junction with cove strip. Butt at top against cap strip.
1. Install metal corners at inside and outside corners.
- 3.4 CLEANING AND PROTECTION
- A. Comply with manufacturer's written instructions for cleaning and protecting resilient sheet flooring.
- B. Perform the following operations immediately after completing resilient sheet flooring installation:
1. Remove adhesive and other blemishes from surfaces.
  2. Sweep and vacuum surfaces thoroughly.
  3. Damp-mop surfaces to remove marks and soil.

- C. Protect resilient sheet flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient sheet flooring until Substantial Completion.

END OF SECTION 09 6516

## SECTION 09 6813 - TILE CARPETING

### 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 modular carpet tile.
- B. Related Requirements:
  - 1. Section 09 6816 "Sheet Carpeting" for carpet roll goods.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
  - 2. Include manufacturer's written installation recommendations for each type of substrate.
- B. Shop Drawings: For carpet tile installation, plans showing the following:
  - 1. Carpet tile type, color, and dye lot.
  - 2. Type of installation.
  - 3. Pattern type, location, and direction.
  - 4. Type, color, and location of edge, transition, and other accessory strips.
  - 5. Transition details to other flooring materials.
- C. Samples for Verification: 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 Tile: Full-size Sample.
  - 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- long Samples.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
  - 1. Methods for maintaining carpet tile, 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 tile.

#### 1.5 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 Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd..

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI's "CRI Carpet Installation Standard."

#### 1.7 FIELD CONDITIONS

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

#### 1.8 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
  1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
  2. Failures include, but are not limited to, the following:
    - a. More than 10 percent edge raveling, snags, and runs.
    - b. Dimensional instability.
    - c. Excess static discharge.
    - d. Loss of tuft-bind strength.
    - e. Loss of face fiber.

f. Delamination.

3. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 CARPET TILE

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products as listed in the Finish schedule.
- B. Primary Backing/Backcoating: Manufacturer's standard composite materials .

### 2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.
- C. Metal Edge/Transition Strips: Extruded aluminum with mill Insert finish finish of profile and width shown, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

## 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 tile performance.
- B. Examine carpet tile for type, color, pattern, and potential defects.
- C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 03 3000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
  - 1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
    - a. 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.

- b. Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
  - c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.
- D. Wood Subfloors: Verify the following:
  - 1. Underlayment over subfloor complies with requirements specified in Section 06 1600 "Sheathing."
  - 2. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. General: Comply with CRI's "Carpet Installation Standards" and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.
- 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. Concrete Substrates: 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 adhesive and carpet tile manufacturers.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

### 3.3 INSTALLATION

- A. General: Comply with CRI's "CRI Carpet Installation Standard," Section 18, "Modular Carpet" and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: As recommended in writing by carpet tile manufacturer.
- C. Maintain dye-lot integrity. Do not mix dye lots in same area.
- D. Cut and fit carpet tile 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 tile manufacturer.

- E. Extend carpet tile 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 carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.
- G. Install pattern parallel to walls and borders.

### 3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
  - 1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
  - 2. Remove yarns that protrude from carpet tile surface.
  - 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with CRI's "Carpet Installation Standard," Section 20, "Protecting Indoor Installations."
- C. Protect carpet tile 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 tile manufacturer.

END OF SECTION 09 6813

## SECTION 09 6816 - SHEET CARPETING

### 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. Tufted carpet.
  - 2. Woven carpet.
- B. Related Requirements:
  - 1. Section 09 6813 "Tile Carpeting" for modular carpet tiles.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For carpet installation, showing the following:
  - 1. Seam locations, types, and methods.
  - 2. Pattern type, repeat size, location, direction, and starting point.
  - 3. Types, colors, and locations of edge, transition, and other accessory strips.
  - 4. 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. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- long Samples.

#### 1.4 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.

1.5 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..

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI's "CRI Carpet Installation Standard."
- B. Deliver carpet in original mill protective covering with mill register numbers and tags attached.

1.7 FIELD CONDITIONS

- A. Comply with CRI's "CRI Carpet Installation Standard" 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 levels planned for building occupants 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.

1.8 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, the following:
    - a. More than 10 percent loss of face fiber, edge raveling, snags, and runs.
    - b. Loss of tuft bind strength.
    - c. Excess static discharge.
    - d. Delamination.
  - 3. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 TUFTED or WOVEN CARPET

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products as listed in the Finish Schedule.

### 2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet and is recommended or provided by carpet 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.
- B. Examine carpet for type, color, pattern, and potential defects.
- C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 03 3000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
  - 1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
    - a. 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.
    - b. Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
    - c. Perform additional moisture tests recommended in writing by adhesive and carpet manufacturers. Proceed with installation only after substrates pass testing.

- D. Wood Subfloors: Verify the following:
  - 1. Underlayment over subfloor complies with requirements specified in Section 06 1600 "Sheathing."
  - 2. Underlayment surface is free of irregularities and substances that may interfere with adhesive bond or show through surface.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. General: Comply with CRI's "CRI Carpet Installation Standard" 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. Concrete Substrates: 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 adhesive and carpet manufacturers.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet.

### 3.3 CARPET INSTALLATION

- A. Comply with CRI's "CRI Carpet Installation Standard" and carpet manufacturer's written installation instructions for the following:
  - 1. Direct-glue-down installation.
- B. Comply with carpet manufacturer's written instructions 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 carpet as marked on subfloor. Use nonpermanent, nonstaining marking device.

### 3.4 CLEANING AND PROTECTION

- 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's "CRI Carpet Installation Standard."
- C. Protect carpet against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods recommended in writing by carpet manufacturer and carpet adhesive manufacturer.

END OF SECTION 09 6816

## SECTION 09 7200 - WALL COVERINGS

### 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. Vinyl wall covering.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show location and extent of each wall-covering type. Indicate pattern placement, seams and termination points.
- C. Samples for Initial Selection: For each type of wall covering.

#### 1.4 CLOSEOUT SUBMITTALS

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

#### 1.5 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. Wall-Covering Materials: For each type, color, texture, and finish, full width by length to equal to 5 percent of amount installed.

#### 1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install wall coverings 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 levels intended for occupants after Project completion during the remainder of the construction period.

- B. Lighting: Do not install wall covering until lighting that matches conditions intended for occupants after Project completion is provided on the surfaces to receive wall covering.
- C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates according to test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
    - a. Flame-Spread Index: 25 or less.
    - b. Smoke-Developed Index: 50 or less.
  - 2. Fire-Growth Contribution: No flashover and heat and smoke release according to NFPA 265.

### 2.2 VINYL WALL COVERING

- A. Basis-of-Design Product: Subject to compliance with requirements, provide:
  - 1. D. L. Couch; Wallcovering Source. Per Finish Schedule.
- B. Description: Provide mildew-resistant products in rolls from same production run and complying with the following:
  - 1. ASTM F 793 for peelable wall coverings.
    - a. Category: II, Decorative with Medium Serviceability .
- C. Width: 54 inches.
- D. Backing: Nonwoven fabric.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for levelness, wall plumbness, maximum moisture content, and other conditions affecting performance of the Work.
- B. 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 that could impair bond of wall covering, including dirt, oil, grease, mold, mildew, and incompatible primers.
- C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.
  - 1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
  - 2. Plaster: Allow new plaster to cure. Neutralize areas of high alkalinity. Prime with primer recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
  - 3. Metals: If not factory primed, clean and apply primer recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
  - 4. Gypsum Board: Prime with primer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
  - 5. Painted Surfaces: Treat areas susceptible to pigment bleeding.
- D. Check painted surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finish with fine sandpaper.
- E. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.
- F. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

### 3.3 WALL-COVERING INSTALLATION

- A. Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated.
- B. Cut wall-covering strips in roll number sequence. Change the roll numbers at partition breaks and corners.

- C. Install strips in same order as cut from roll.
  - 1. For solid-color, even-texture, or random-match wall coverings, reverse every other strip.
- D. Install wall covering without lifted or curling edges and without visible shrinkage.
- E. Match pattern 72 inches above the finish floor.
- F. Install seams vertical and plumb at least 6 inches from outside corners and [3 inches] [6 inches] from inside corners unless a change of pattern or color exists at corner. Horizontal seams are not permitted.
- G. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without overlaps or gaps between strips.
- H. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

END OF SECTION 09 7200

## SECTION 09 7723 - FABRIC-WRAPPED PANELS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes shop-fabricated, fabric-wrapped wall panels.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include fabric facing, panel edge, core material, and mounting indicated.
- B. Shop Drawings: For panel assembly and installation.
  - 1. Include plans, elevations, sections, and mounting devices and details.
  - 2. Include details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge profile and core materials.
  - 3. Include details at cutouts and penetrations for other work.
  - 4. Include direction of fabric weave and pattern matching.
- C. Samples for Verification: For the following products:
  - 1. Fabric: Full-width by approximately 12-inch- long Sample, but not smaller than required to show complete pattern repeat, from dye lot to be used for the Work, and with specified treatments applied. Mark top and face of fabric.
  - 2. Panel Edge: 12-inch- long Sample(s) showing each edge profile, corner, and finish.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of panel to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal instructions.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials from same production run that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fabric: For each fabric, color, and pattern installed, provide length equal to 10 percent of amount installed, but no fewer than 10 sq. yd., full width of bolt.
  - 2. Mounting Devices: Full-size units equal to 5 percent of amount installed, but no fewer than five devices, including unopened adhesives.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with fabric and panel manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
- B. Deliver materials and panels in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install panels until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Lighting: Do not install panels until a permanent level of lighting is provided on surfaces to receive the panels.
- C. Air-Quality Limitations: Protect panels from exposure to airborne odors such as tobacco smoke, and install panels under conditions free from odor contamination of ambient air.
- D. Field Measurements: Verify panel locations and actual dimensions of openings and penetrations by field measurements before fabrication, and indicate them on Shop Drawings.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace panels and components that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Fabric sagging, distorting, or releasing from panel edge.
    - b. Warping of core.
  - 2. Warranty Period: Two years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain fabric-wrapped wall panels from single source from single manufacturer.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Panels shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Fire-Test-Response Characteristics: Panels shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
  - 1. 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.
    - a. Flame-Spread Index: 25 or less.
    - b. Smoke-Developed Index: 450 or less.
  - 2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

### 2.3 FABRIC-WRAPPED WALL PANELS

- A. Fabric-Wrapped Wall Panel : Manufacturer's standard panel construction.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Audimute or approved equal.
  - 2. Panel Shape: As indicated on Drawings.
  - 3. Mounting: Back mounted with manufacturer's standard metal clips or bar hangers, secured to substrate.

### 2.4 FABRICATION

- A. Standard Construction: Use manufacturer's standard construction unless otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warpage and damage.



- B. Dimensional Tolerances of Finished Panels: Plus or minus 1/16 inch.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine fabric, fabricated panels, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting panel performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Install panels in locations indicated. Unless otherwise indicated, install panels with vertical surfaces and edges plumb, top edges level and in alignment with other panels, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.
- B. Comply with manufacturer's written instructions for installation of panels using type of mounting devices indicated. Mount panels securely to supporting substrate.

#### 3.3 INSTALLATION TOLERANCES

- A. Variation from Plumb and Level: Plus or minus 1/16 inch in 48 inches , noncumulative.

#### 3.4 CLEANING

- A. Clip loose threads; remove pills and extraneous materials.
- B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 09 7723

## SECTION 09 8436 - SOUND-ABSORBING CEILING UNITS

### 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 DEFINITIONS

- A. NRC: Noise Reduction Coefficient.
- B. SAA: Sound Absorption Average.

#### 1.3 ACTION SUBMITTALS

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

#### 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of unit to include in maintenance manuals. Include fabric manufacturer's written cleaning and stain-removal instructions.

#### 1.5 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.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with fabric and unit manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.
- B. Deliver materials and units in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

#### 1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

- B. Lighting: Do not install units until a permanent level of lighting is provided on surfaces to receive the units.
- C. Air-Quality Limitations: Protect units from exposure to airborne odors, such as tobacco smoke, and install units under conditions free from odor contamination of ambient air.
- D. Field Measurements: Verify unit locations and actual dimensions of openings and penetrations by field measurements before fabrication, and indicate them on Shop Drawings.

## 1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace units and components that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Acoustical performance.
  - 2. Warranty Period: Two years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain ceiling units specified in this Section from single source from single manufacturer.

### 2.2 SOUND-ABSORBING CEILING UNITS

- A. Sound-Absorbing Ceiling Panel : Manufacturer's standard panel. .
  - 1. Manufacturers: Subject to compliance with requirements, Basis of Design product: Zintra; Frost or approved equal.
  - 2. Panel Shape: As indicated on Drawings.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine fabric, fabricated units, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting unit performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install units in locations indicated. Unless otherwise indicated, install units with edges in alignment with walls and other units, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.
- B. Comply with manufacturer's written instructions for installation of units using type of adhesive as indicated. Mount units securely to supporting substrate.
- C. Align fabric pattern and grain as indicated on Drawings.

### 3.3 INSTALLATION TOLERANCES

- A. Variation from Alignment with Surfaces: Plus or minus 1/16 inch in 48 inches , noncumulative.
- B. Variation from Level or Slope: Plus or minus 1/16 inch .

### 3.4 CLEANING

- A. Clip loose threads; remove pills and extraneous materials.
- B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 09 8436

## SECTION 09 91 13 - EXTERIOR PAINTING

### 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 surface preparation and the application of paint systems on the following exterior substrates:
  - 1. Clay masonry.
  - 2. Steel and iron.
  - 3. Galvanized metal.
  - 4. Wood.
- B. Related Requirements:
  - 1. Section 05 5000 "Metal Fabrications" for shop priming metal fabrications.
  - 2. Section 05 5213 "Pipe and Tube Railings" for shop priming pipe and tube railings.

#### 1.3 DEFINITIONS

- A. MPI Gloss Level 1: Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- D. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- E. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- F. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
  - 1. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
  - 2. Indicate VOC content.
- B. Samples for Verification: For each type of paint system and each color and gloss of topcoat.
  - 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.
- C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

#### 1.5 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: 5 percent, but not less than Insert value of each material and color applied.

#### 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 in snow, rain, fog, or mist; 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: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Benjamin Moore & Co.
  - 2. Diamond Vogel Paints.
  - 3. PPG Architectural Finishes, Inc.
  - 4. Sherwin-Williams Company (The).

### 2.2 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."

## 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. Masonry (Clay and CMUs): 12 percent.
  - 2. Wood: 15 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- D. 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 in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

- 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.
- 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. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- E. 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 2.
  - 2. SSPC-SP 3.
- F. 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.
- G. 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.
- H. Wood Substrates:
  - 1. Scrape and clean knots. Before applying primer, apply coat of knot sealer recommended in writing by topcoat manufacturer for exterior use in paint system indicated.
  - 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.

### 3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
  - 1. Use applicators and techniques suited for paint and substrate indicated.



2. Paint surfaces behind movable items same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed items with prime coat only.
  3. Paint both sides and edges of exterior doors and entire exposed surface of exterior door frames.
  4. Paint entire exposed surface of window frames and sashes.
  5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
  6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- C. 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.
- D. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
1. Paint the following work where exposed to view:
    - a. Equipment, including panelboards.
    - b. Uninsulated metal piping.
    - c. Uninsulated plastic piping.
    - d. Pipe hangers and supports.
    - e. Metal conduit.
    - f. Tanks that do not have factory-applied final finishes.

### 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 EXTERIOR PAINTING SCHEDULE

#### A. Clay Masonry Substrates:

- 1. 100% Acrylic Topcoat breathable:
  - a. Prime Coat: exterior, matching topcoat.
  - b. Intermediate Coat: exterior, matching topcoat.
  - c. Topcoat: exterior, flat (MPI Gloss Level 1).

#### B. Steel and Iron Substrates:

- 1. Water-Based Light Industrial Coating System MPI EXT 5.1C:
  - a. Prime Coat: Primer, alkyd, anti-corrosive for metal, MPI #79.
    - 1) Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
  - b. Topcoat: Light industrial coating, exterior, water based, semi-gloss (MPI Gloss Level 5), MPI #163.

#### C. Galvanized-Metal Substrates:

- 1. Latex System MPI EXT 5.3H:
  - a. Prime Coat: Primer, galvanized, water based, MPI #134.
  - b. Intermediate Coat: Latex, exterior, matching topcoat.
  - c. Topcoat: Latex, exterior, semi-gloss (MPI Gloss Level 5), MPI #11.

#### D. Wood Substrates: Wood trim Windows.

- 1. Latex over Latex Primer System MPI EXT 6.3L:
  - a. Prime Coat: Primer, latex for exterior wood, MPI #6.
  - b. Intermediate Coat: Latex, exterior, matching topcoat.
  - c. Topcoat: Latex, exterior, flat (MPI Gloss Level 1), MPI #10.

END OF SECTION 09 9113

## SECTION 09 9123 - INTERIOR PAINTING

### 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 surface preparation and the application of paint systems on the following interior substrates:
  - 1. Clay masonry.
  - 2. Steel and iron.
  - 3. Wood.
  - 4. Gypsum board.
- B. Related Requirements:
  - 1. Section 05 5000 "Metal Fabrications" for shop priming metal fabrications.
  - 2. Section 05 5213 "Pipe and Tube Railings" for shop priming pipe and tube railings.
  - 3. Section 09 9300 "Staining and Transparent Finishing" for surface preparation and the application of wood stains and transparent finishes on interior wood substrates.

#### 1.3 DEFINITIONS

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

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
  - 1. Include Printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.
  - 2. Indicate VOC content.
- B. Samples for Initial Selection: For each type of topcoat product.
- C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

#### 1.5 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: 5 percent, but not less than 1 gal. of each material and color applied.

#### 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: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Benjamin Moore & Co.
  - 2. Diamond Vogel Paints.

3. PPG Architectural Coatings.
4. Sherwin-Williams Company (The).

## 2.2 PAINT, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products Lists."
- B. 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.

## 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. Masonry (Clay and CMUs): 12 percent.
  2. Wood: 15 percent.
  3. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- E. 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 in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

- 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 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. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.
- E. 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 2.
  - 2. SSPC-SP 3.
- F. 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.
- G. 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.

### 3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
  - 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.
  - B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
  - C. 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.
  - D. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
    1. Paint the following work where exposed in equipment rooms:
      - a. Equipment, including panelboards.
      - b. Uninsulated metal piping.
      - c. Uninsulated plastic piping.
      - d. Pipe hangers and supports.
      - e. Metal conduit.
      - f. Tanks that do not have factory-applied final finishes.
      - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
    2. 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. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
      - g. Other items as directed by Architect.
    3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.
- 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. Clay Masonry Substrates:
  - 1. Latex System MPI INT 4.1A:
    - a. Prime Coat: Primer, alkali resistant, water based, MPI #3.
    - b. Intermediate Coat: Latex, interior, matching topcoat.
    - c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), MPI #53.
- B. Steel Substrates:
  - 1. Latex System, Alkyd Primer MPI INT 5.1QQ:
    - a. Prime Coat: Primer, alkyd, anti-corrosive, for metal, MPI #79.
    - b. Intermediate Coat: Latex, interior, matching topcoat.
    - c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), MPI #53.
- C. Wood Substrates: Wood trim Doors.
  - 1. Water-Based Alkyd System MPI INT 6.3BB:
    - a. Prime Coat: Primer, latex, for interior wood, MPI #39.
    - b. Intermediate Coat: Alkyd, water based, matching topcoat.
    - c. Topcoat: Alkyd, water based, gloss (MPI Gloss Level 6-7), MPI #157.
- D. Gypsum Board and Substrates:
  - 1. Latex over Latex Sealer System MPI INT 9.2A:
    - a. Prime Coat: Primer sealer, latex, interior, MPI #50.
    - b. Intermediate Coat: Latex, interior, matching topcoat.



- c. Topcoat: Latex, interior, flat (MPI Gloss Level 1), MPI #53.
  - 1) Locations: Ceilings.
- d. Topcoat: Latex, interior (MPI Gloss Level 3), MPI #52.
  - 1) Locations: Walls.

END OF SECTION 09 9123

## SECTION 09 9300 - STAINING AND TRANSPARENT FINISHING

### 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 surface preparation and application of wood stains and transparent finishes on the following substrates:

- 1. Interior Substrates:

- a. Dressed lumber (finish carpentry or woodwork).
    - b. Wood-based panel products.
    - c. Wood floors and stairs.

- B. Related Requirements:

- 1. Section 09 9123 "Interior Painting" for stains and transparent finishes on concrete floors.

#### 1.3 DEFINITIONS

- A. MPI Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- D. MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- E. MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.

- B. Samples for Verification: For each type of finish system and in each color and gloss of finish required.

- 1. Submit Samples on representative samples of actual wood substrates, 8 inches square or 8 inches long.

#### 1.5 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. Stains and Transparent Finishes: 5 percent, but not less than 1 gal. of each material and color applied.

#### 1.6 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each finish system indicated and each color selected to verify preliminary selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

- 1. Architect will select one surface to represent surfaces and conditions for application of each type of finish system and substrate.
    - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..

#### 1.7 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.

#### 1.8 FIELD CONDITIONS

- A. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply finishes 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 finishes in snow, rain, fog, or mist.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Behr Process Corporation.
  2. Benjamin Moore & Co.
  3. Diamond Vogel Paints.
  4. Glidden Professional.
  5. Kelly-Moore Paint Company Inc.
  6. PPG Architectural Finishes, Inc.
  7. Rust-Oleum Corporation; a subsidiary of RPM International, Inc.
  8. Sherwin-Williams Company (The).

### 2.2 MATERIALS, GENERAL

- A. MPI Standards: Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products List."

## 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 Exterior Wood Substrates: 15 percent, when measured with an electronic moisture meter.
- C. Maximum Moisture Content of Interior Wood Substrates: 15 percent, when measured with an electronic moisture meter.
- D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- E. Proceed with finish application only after unsatisfactory conditions have been corrected.
1. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.

### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.
  - 1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each substrate condition and as specified.
  - 1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
  - 2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.
- D. Interior Wood Substrates:
  - 1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
  - 2. Apply wood filler paste to open-grain woods, as defined in "MPI Architectural Painting Specification Manual," to produce smooth, glasslike finish.
  - 3. Sand surfaces exposed to view and dust off.
  - 4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dry.

### 3.3 APPLICATION

- A. Apply finishes according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."
  - 1. Use applicators and techniques suited for finish and substrate indicated.
  - 2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.
  - 3. Do not apply finishes over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

### 3.4 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

- B. After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from finish application. Correct damage 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 finished wood surfaces.

### 3.5 INTERIOR WOOD -FINISH-SYSTEM SCHEDULE

- A. Wood Substrates: casework.
  - 1. Water-Based Varnish over Stain System MPI INT 6.4U:
    - a. Stain Coat: Stain, semitransparent, for interior wood, MPI #90.
    - b. First Intermediate Coat: Water-based varnish matching topcoat.
    - c. Topcoat: Varnish, water based, clear, satin (MPI Gloss Level 4), MPI #128.
- B. Wood Substrates: Traffic surfaces including floors and stairs.
  - 1. Polyurethane Varnish over Stain System MPI INT 6.5B:
    - a. Stain Coat: Stain, semitransparent, for interior wood, MPI #90.
    - b. First Intermediate Coat: Polyurethane varnish matching topcoat.
    - c. Second Intermediate Coat: Polyurethane varnish matching topcoat.
    - d. Topcoat: Varnish, interior, polyurethane, waterborne. Basis of design product S-W Varnish A68.

END OF SECTION 09 9300

## SECTION 10 21 13.17 - PHENOLIC-CORE TOILET COMPARTMENTS

### 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. Phenolic-core toilet compartments configured as toilet enclosures.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for toilet compartments.
- B. Shop Drawings: For toilet compartments.
  - 1. Include plans, elevations, sections, details, and attachment details.

#### 1.4 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

### PART 2 - PRODUCTS

#### 2.1 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. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities for toilet compartments designated as accessible.

## 2.2 PHENOLIC-CORE TOILET COMPARTMENTS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Accurate Partitions Corporation.
  2. All American Metal Corp.
  3. American Sanitary Partition Corporation.
  4. Ampco, Inc.
  5. Bobrick Washroom Equipment, Inc.
  6. Bradley Corporation; Mills Partitions.
  7. Decolam.
  8. Flush Metal Partition Corp.
  9. General Partitions Mfg. Corp.
  10. Global Steel Products Corp.
  11. Knickerbocker Partition Corporation.
  12. Marlite.
  13. Metpar Corp.
  14. Partition Systems Incorporated of South Carolina; Columbia Partitions.
  15. Scranton Products.
  16. Spec-Rite Designs, LLC; DesignRite Partitions.
  17. Tex-Lam Manufacturing, Inc.
  18. Weis-Robart Partitions, Inc.
- B. Toilet-Enclosure Style: Overhead braced Floor anchored.
- C. Door, Panel, and Pilaster Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges[ and no-sightline system]. Provide minimum 3/4-inch- thick doors and pilasters and minimum 1/2-inch- thick panels.
- D. Pilaster Shoes and Sleeves (Caps): Formed from stainless-steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.
- E. Brackets (Fittings):
1. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.
- F. Phenolic-Panel Finish:
1. Facing Sheet Finish: One color and pattern in each room.
  2. Color and Pattern: As selected by Architect from manufacturer's full range, with manufacturer's standard through-color core matching face sheet.
  3. Edge Color: Through-color matching facing sheet color.



## 2.3 HARDWARE AND ACCESSORIES

- A. Hardware and Accessories: Manufacturer's standard operating hardware and accessories.
  - 1. Material: Stainless steel.
  - 2. Hinges: Manufacturer's standard paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees , allowing emergency access by lifting door.
  - 3. Latch and Keeper: Manufacturer's standard surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
  - 4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
  - 5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
  - 6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.
- B. Hardware and Accessories: Manufacturer's heavy-duty operating hardware and accessories.
  - 1. Hinges: Manufacturer's minimum 0.062-inch- thick stainless-steel paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees , allowing emergency access by lifting door. Mount with through-bolts.

## 2.4 MATERIALS

- A. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.

## 2.5 FABRICATION

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
- B. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
- C. Door Size and Swings: Unless otherwise indicated, provide 24-inch- wide in-swinging doors for standard toilet compartments and 36-inch- wide out-swinging doors with a minimum 32-inch- wide clear opening for compartments designated as accessible.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
  - 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
  - 1. Maximum Clearances:
    - a. Pilasters and Panels: 1/2 inch.
    - b. Panels and Walls: 1 inch.
  - 2. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.
- B. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.

### 3.3 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 10 2113.17

## SECTION 10 2800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Public-use washroom accessories.
  - 2. Childcare accessories.
  - 3. Underlavatory guards.
  - 4. Custodial accessories.

#### 1.3 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
  - 2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
  - 3. Include electrical characteristics.
- B. Samples: Full size, for each exposed product and for each finish specified.
  - 1. Approved full-size Samples will be returned and may be used in the Work.

#### 1.5 CLOSEOUT SUBMITTALS

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

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

### 2.2 PUBLIC-USE WASHROOM ACCESSORIES

- A. Source Limitations: Obtain public-use washroom accessories from single source from single manufacturer.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. A&J Washroom Accessories, Inc.
    - b. American Specialties, Inc.; ASI Group.
    - c. Bobrick Washroom Equipment, Inc.
    - d. Bradley Corporation.
    - e. Brey-Krause Manufacturing Co.
  - 2. Description: See Schedule in drawings.

### 2.3 CHILDCARE ACCESSORIES

- A. Source Limitations: Obtain childcare accessories from single source from single manufacturer.

### 2.4 UNDERLAVATORY GUARDS

- A. Underlavatory Guard Insert drawing designation:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. 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.

## 2.5 CUSTODIAL ACCESSORIES

- A. Source Limitations: Obtain custodial accessories from single source from single manufacturer.
- B. Utility Shelf <Insert drawing designation>:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. A&J Washroom Accessories, Inc.
    - b. American Specialties, Inc.; ASI Group.
    - c. Bobrick Washroom Equipment, Inc.
    - d. Bradley Corporation.

## 2.6 MATERIALS

- A. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
- B. Galvanized-Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- C. 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.

## 2.7 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 instructions.

END OF SECTION 10 2800

## SECTION 10 4413 - FIRE PROTECTION CABINETS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Fire-protection cabinets for the following:
    - a. Portable fire extinguishers.
- B. Related Requirements:
  - 1. Section 10 4416 "Fire Extinguishers."

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.
- B. Shop Drawings: For fire-protection cabinets. Include plans, elevations, sections, details, and attachments to other work.

#### 1.4 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

#### 1.5 SEQUENCING

- A. Apply decals on field-painted fire-protection cabinets after painting is complete.

## 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 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Guardian Fire Equipment, Inc.
    - b. JL Industries, Inc.; a division of the Activar Construction Products Group.
    - c. Larsens Manufacturing Company.
    - d. Modern Metal Products, Division of Technico Inc.
- B. Cabinet Material: Cold-rolled steel sheet.
  - 1. Shelf: Same metal and finish as cabinet.
- C. Semirecessed Cabinet: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
  - 1. Square-Edge Trim: 1-1/4- to 1-1/2-inch backbend depth.
  - 2. Rolled-Edge Trim: 2-1/2-inch Insert dimension backbend depth.
- D. Cabinet Trim Material: Steel sheet.
- E. Door Material: Steel sheet.
- F. Door Style: Fully glazed panel with frame.
- G. Door Glazing: Tempered float glass (clear).
- H. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
- I. Accessories:
  - 1. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated .
    - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."
      - 1) Location: Applied to cabinet door.
      - 2) Application Process: Decals.



- 3) Lettering Color: Red.
- 4) Orientation: Vertical.

J. Materials:

1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
  - a. Finish: Baked enamel or powder coat.
  - b. Color: White .

2.3 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
  1. Weld joints and grind smooth.
  2. Provide factory-drilled mounting holes.
  3. Prepare doors and frames to receive locks.
  4. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
  1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
  2. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Prepare recesses for semirecessed fire-protection cabinets as required by type and size of cabinet and trim style.

### 3.3 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated in drawings.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
  - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
  - 2. Provide inside latch and lock for break-glass panels.
    - a. Install cabinet with not more than 1/16-inch tolerance between pipe OD and knockout OD. Center pipe within knockout.
    - b. Seal through penetrations with firestopping sealant as specified in Section 07 8413 "Penetration Firestopping."
- C. Identification: Apply decals at locations indicated.

### 3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 4413

## SECTION 10 4416 - FIRE EXTINGUISHERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

#### 1.6 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

#### 1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

- 1. Failures include, but are not limited to, the following:

- a. Failure of hydrostatic test according to NFPA 10.
- b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
  1. Provide fire extinguishers approved, listed, and labeled by FM Global.

### 2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
  1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  2.
    - a. Amerex Corporation.
    - b. Ansul Incorporated.
    - c. Guardian Fire Equipment, Inc.
    - d. JL Industries, Inc.; a division of the Activar Construction Products Group.
    - e. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
    - f. Larsens Manufacturing Company.
    - g. Nystrom Building Products.
  3. Valves: Manufacturer's standard.
  4. Handles and Levers: Manufacturer's standard.
  5. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.
- B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

## 2.3 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Amerex Corporation.
    - b. Ansul Incorporated.
    - c. Guardian Fire Equipment, Inc.
    - d. JL Industries, Inc.; a division of the Activar Construction Products Group.
    - e. Larsens Manufacturing Company.
    - f. Nystrom Building Products.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
  - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
    - a. Orientation: Vertical.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
  - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
  - 1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 10 4416

## SECTION 12 2200 - CURTAINS AND DRAPES

### 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. Drapes.
  - 2. Drapery tracks.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Drapery Tracks: Include maximum weights of drapes that can be supported.
- B. Shop Drawings:
  - 1. Drapery Tracks: Show installation and anchorage details and locations of controls.
- C. Samples for Verification: As follows:
  - 1. Drapery Tracks: 18 inches long, with carriers, controls, and accessories.
  - 2. Drapery Fabrics: For each color and pattern indicated, full width by 36 inches long, from dye lot to be used for the Work and with specified textile treatments applied. Show complete pattern repeat if any. Mark top and face of fabric.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: For drapery track installation; reflected ceiling plans drawn to scale and coordinating track installation with openings and ceiling-mounted items, on which the following items are shown:

#### 1.5 CLOSEOUT SUBMITTALS

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

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: For drapes and drapery tracks, fabricator of drapes.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions by field measurements before drape fabrication, and indicate measurements on Shop Drawings.
- B. Scheduling: Do not deliver or install drapes until after other finish work, including painting, is complete and spaces are otherwise ready for occupancy.

PART 2 - PRODUCTS

2.1 DRAPERY TRACKS

- 1. Manual.

2.2 DRAPES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
  - 1. WT-3 (ripple fold).
    - a. Textile: See Finish Legend.
    - b. Heading System: Woven snap tape.
    - c. Fullness: 120 percent.
    - d. Bottom Hems:
      - 1) Four (4), double turned, three layers of fabric and blind stitched. 1-inch square lead weight s securely sewn at each seam and at the corners.
    - e. Hardware:
      - 1) Basis of design: Manufacturer: Kirsch, Series: Architrac Series 94001.
    - f. Fascia: Yes.
    - g. Lining: None.
    - h. Operation Type: Cord pull, verify location of cord with Architect.
    - i. Track Installation: Wall, just above window head, verify with Architect.
    - j. Draw Type: Split-draw.
    - k. Master Type: Butt Master.



2. WT-4 (ripple fold)

- a. Textile: See Finish Legend.
- b. Heading System: Woven snap tape.
- c. Fullness: 120 percent.
- d. Side Hems: Double- turned, 1-½-inches wide. Three layers of fabric and blind stitched so no stitches are visible.
- e. Bottom Hems:
  - 1) Four (4), double turned, three layers of fabric and blind stitched. String weights shall be inserted into hems.
- f. Lining: None.
- g. Hardware:
  - 1) Basis of design: Manufacturer: Kirsch, Series: No. 9046 Track.
- h. Operation Type: Wand pull, verify location of wand with Architect.
- i. Track Installation: Ceiling.
- j. Draw Type: One-way.
- k. Master Type: Butt Master.

3. WT-5 (ripple fold)

- a. Textile: See Finish Legend.
- b. Heading System: Woven snap tape.
- c. Fullness: 120 percent.
- d. Bottom Hems:
  - 1) Four (4), double turned, three layers of fabric and blind stitched. String weights shall be inserted into hems.
- e. Hardware:
  - 1) Basis of design: Manufacturer: Kirsch, Series: Architrac Series 94001.
- f. Fascia: Yes.
- g. Lining: None.
- h. Operation Type: Cord pull, verify location of cord with Architect.
- i. Track Installation: wall, just above window head, verify with Architect.
- j. Draw Type: Split-draw.
- k. Master Type: Butt Master.

B. Source Limitations: Obtain each color and pattern of drapery fabric and trim from one dye lot.

C. Fire-Test-Response Characteristics: For fabrics treated with fire retardants, provide products that pass NFPA 701 as determined by testing of fabrics that were treated using treatment-application method intended for use for this Project by a testing and inspecting agency acceptable to authorities having jurisdiction.

## 2.3 DRAPE FABRICATION

- A. Fabricate drapes in heading styles and fullnesses indicated. Fabricate headings to stand erect. If less than a full width of fabric is required to produce panel of specified fullness, use equal widths of not less than one-half width of fabric located at ends of panel.
  - 1. One-Way-Stacking Drapes: Add 5 inches to overall width for returns.
  - 2. Center-Opening Drapes: Add 10 inches to overall width for overlap.

## PART 3 - EXECUTION

### 3.1 DRAPERY TRACK INSTALLATION

- A. Install track systems according to manufacturer's written instructions, level and plumb, and at height and location in relation to adjoining openings as indicated on Drawings.
- B. Isolate metal parts of tracks and brackets from concrete, masonry, and mortar to prevent galvanic action. Use tape or another method recommended in writing by track manufacturer.

### 3.2 DRAPE INSTALLATION

- A. Where drapes abut overhead construction, hang drapes so that clearance between headings and overhead construction is 1/4 inch .
- B. Where drapes extend to floor, install so that bottom hems clear finished floor by not more than 1 inch and not less than 1/2 inch .
- C. Where drapes extend to windowsill, install so that bottom hems hang above sill line and clear sill line by not more than 1/2 inch .

### 3.3 ADJUSTING

- A. After hanging drapes, test and adjust each drapery track to produce unencumbered, smooth operation.
- B. Steam and dress down drapes as required to produce crease- and wrinkle-free installation.
- C. Remove and replace drapes that are stained or soiled.

END OF SECTION 12 2200

## SECTION 12 2413 - ROLLER WINDOW SHADES

### 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. Manually operated roller shades with single rollers.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.
- B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.
  - 1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.
- C. Samples for Verification: For each type of roller shade.
  - 1. Roller Shade: Full-size operating unit, not less than 16 inches wide by 36 inches long for each type of roller shade indicated.
  - 2. Installation Accessories: Full-size unit, not less than 10 inches long.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of shadeband material.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roller shades 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. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than two units.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, 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: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated in Finish Schedule.

- B. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
  - 1. Bead Chains: Manufacturer's standard .
    - a. Loop Length: Full length of roller shade.
    - b. Limit Stops: Provide upper and lower ball stops.
    - c. Chain-Retainer Type: Clip, jamb mount .
- C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
  - 1. Roller Drive-End Location: Right side of interior face of shade.
  - 2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
  - 3. Shadeband-to-Roller Attachment: Manufacturer's standard method.
- D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- E. Shadebands:
  - 1. Shadeband Material: See Finish Schedule.
  - 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
    - a. Color and Finish: See Finish Schedule.
- F. Installation Accessories:
  - 1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
    - a. Shape: L-shaped.
    - b. Height: Manufacturer's standard height required to conceal roller and shadeband assembly when shade is fully open, but not less than 3 inches .

## 2.3 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Fabric: See Finish Schedule.

## 2.4 ROLLER SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:
  - 1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch . Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch , plus or minus 1/8 inch .

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 ROLLER SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
- B. Roller Shade Locations: As indicated on Drawings.

### 3.3 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

### 3.4 CLEANING AND PROTECTION

- A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 12 2413

## SECTION 12 3623.13 - PLASTIC-LAMINATE-CLAD COUNTERTOPS

### 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 plastic-laminate-clad countertops.

#### 1.3 DELIVERY, STORAGE, AND HANDLING

- A. Deliver countertops only after casework and supports on which they will be installed have been completed in installation areas.
- B. Store countertops in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.
- C. Keep surfaces of countertops covered with protective covering during handling and installation.

#### 1.4 FIELD CONDITIONS

- A. Field Measurements: Where countertops are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- B. Established Dimensions: Where countertops are indicated to fit to other construction, establish dimensions for areas where countertops are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

### PART 2 - PRODUCTS

#### 2.1 PLASTIC-LAMINATE-CLAD COUNTERTOPS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of plastic-laminate-clad countertops indicated for construction, finishes, installation, and other requirements.
  - 1. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.



- B. High-Pressure Decorative Laminate: NEMA LD 3, Grade HGS .
- C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
  - 1. As indicated in the Finish Schedule.
- D. Core Material: Particleboard or MDF.

## 2.2 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard unless otherwise indicated.
  - 1. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of countertop and quality grade specified unless otherwise indicated.

## 2.3 MISCELLANEOUS MATERIALS

- A. 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."
- B. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement .
- C. Installation Adhesive:
  - 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."

## 2.4 FABRICATION

- A. Fabricate countertops to dimensions, profiles, and details indicated. Provide front and end overhang of 1 inch over base cabinets. Ease edges to radius indicated for the following:
  - 1. Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
- B. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
  - 1. Notify Architect seven days in advance of the dates and times countertop fabrication will be complete.

2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended, and check measurements of assemblies against field measurements before disassembling for shipment.
- C. Shop cut openings to maximum extent possible to receive appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately, and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
  1. Seal edges of cutouts by saturating with varnish.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Before installation, condition countertops to average prevailing humidity conditions in installation areas.
- B. Before installing countertops, examine shop-fabricated work for completion and complete work as required, including removal of packing.

#### 3.2 INSTALLATION

- A. Grade: Install countertops to comply with same grade as item to be installed.
- B. Assemble countertops and complete fabrication at Project site to the extent that it was not completed in the shop.
  1. Provide cutouts for appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately, and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
- C. Field Jointing: Where possible, make in the same manner as shop jointing, using dowels, splines, adhesives, and fasteners recommended by manufacturer. Prepare edges to be joined in shop so Project-site processing of top and edge surfaces is not required. Locate field joints where shown on Shop Drawings.
  1. Secure field joints in countertops with concealed clamping devices located within 6 inches of front and back edges and at intervals not exceeding 24 inches. Tighten according to manufacturer's written instructions to exert a constant, heavy-clamping pressure at joints.
- D. Scribe and cut countertops to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

- E. Countertop Installation: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
  - 1. Install countertops level and true in line. Use concealed shims as required to maintain not more than a 1/8-inch-in-96-inches variation from a straight, level plane.
  - 2. Seal joints between countertop and backsplash, if any, and joints where countertop and backsplash abut walls with mildew-resistant silicone sealant or another permanently elastic sealing compound recommended by countertop material manufacturer.

### 3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective countertops, where possible, to eliminate functional and visual defects. Where not possible to repair, replace countertops. Adjust joinery for uniform appearance.
- B. Clean countertops on exposed and semiexposed surfaces.
- C. Protection: Provide Kraft paper or other suitable covering over countertop surfaces, taped to underside of countertop at a minimum of 48 inches o.c. Remove protection at Substantial Completion.

END OF SECTION 12 3623.13

## SECTION 12 3661.13 - CULTURED MARBLE COUNTERTOPS

### 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. Cultured marble countertops.
- B. Related Requirements:
  - 1. Section 22 4000 "Residential Plumbing Fixtures" for plumbing fittings.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For countertop materials.
- B. Samples for Verification: For the following products:
  - 1. Countertop material, 6 inches square.

#### 1.4 COORDINATION

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings

#### 2.2 CULTURED MARBLE COUNTERTOPS

- A. Cultured Marble: Gel-coated solid fabrication of filled plastic resin complying with CSA B45.5/IAPMO Z124.

- B. Configuration: One-piece units with integral sink bowls and backsplashes unless otherwise indicated, not less than 1/2 inch thick.

- 1. Front: Straight, slightly eased at top.

## 2.3 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by cultured marble manufacturer.
- B. Sealant for Countertops: Comply with applicable requirements in Section 07 9200 "Joint Sealants."

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet.
- B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer.
  - 1. Install end splashes to comply with manufacturer's written instructions.
- C. Install aprons to backing and countertops with adhesive. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.
- D. Apply sealant to gaps at walls; comply with Section 07 9200 "Joint Sealants." Remove temporary shims before applying sealant.

END OF SECTION 12 3661.13

## SECTION 12 3661.19 - QUARTZ AGGLOMERATE COUNTERTOPS

### 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. Quartz agglomerate countertops.
- B. Related Requirements:
  - 1. Section 22 4100 "Residential Plumbing Fixtures" for sinks and plumbing fittings.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For countertop materials.
- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
  - 1. Show locations and details of joints.
  - 2. Show direction of directional pattern, if any.
- C. Samples for Verification: For the following products:
  - 1. Countertop material, 6 inches square.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For quartz agglomerate countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

#### 1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.
- B. Installer Qualifications: Fabricator of countertops.

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.7 COORDINATION

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 QUARTZ AGGLOMERATE COUNTERTOP MATERIALS

- A. Quartz Agglomerate: Solid sheets consisting of quartz aggregates bound together with a matrix of filled plastic resin and complying with ICPA SS-1, except for composition.
  - 1. Manufacturers: Subject to compliance with requirements, provide products as listed in the Finish Schedule.
- B. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged, touch sanded.

2.2 COUNTERTOP FABRICATION

- A. Fabricate countertops according to quartz agglomerate manufacturer's written instructions and the AWI/AWMAC/WI's "Architectural Woodwork Standards."
  - 1. Grade: Premium.
- B. Configuration:
  - 1. Front: Straight, slightly eased at top.
- C. Countertops: 3/4-inch- thick, quartz agglomerate with front edge built up with same material.
- D. Fabricate tops with shop-applied edges unless otherwise indicated. Comply with quartz agglomerate manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
- E. Joints: Fabricate countertops in sections for joining in field.
  - 1. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.
  - 2. Joint Type: Bonded, 1/32 inch or less in width.

F. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures[ in shop] using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
  - a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.
2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.

2.3 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by quartz agglomerate manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to receive quartz agglomerate countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.
- B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with quartz agglomerate manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- C. Fasten subtops to cabinets by screwing through subtops into cornerblocks of base cabinets. Shim as needed to align subtops in a level plane.



- D. Secure countertops to subtops with adhesive according to quartz agglomerate manufacturer's written instructions. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with quartz agglomerate manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- E. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
  - 1. Install metal splines in kerfs in countertop edges at joints where indicated. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
  - 2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.
- F. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- G. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.
- H. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
- I. Apply sealant to gaps at walls; comply with Section 07 9200 "Joint Sealants."

END OF SECTION 12 3661.19

## SECTION 14 2400 - HYDRAULIC ELEVATORS

### 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 hydraulic passenger elevators.
- B. Related Requirements:
  - 1. Section 01 5000 "Temporary Facilities and Controls" for temporary use of elevators for construction purposes.
  - 2. Section 05 1200 "Structural Steel Framing" for the following:
    - a. Attachment plates, angle brackets, and other structural-steel preparations for fastening guide-rail brackets.
    - b. Divider beams.
    - c. Hoist beams.
    - d. Structural-steel shapes for subsills that are part of steel frame.
  - 3. Section 28 4621.11 "Addressable Fire-Alarm Systems" for smoke detectors in elevator lobbies to initiate emergency recall operation and heat detectors in shafts and machine rooms to disconnect power from elevator equipment before sprinkler activation and for connection to elevator controllers.

#### 1.3 DEFINITIONS

- A. Definitions in ASME A17.1/CSA B44 apply to work of this Section.
- B. Service Elevator: A passenger elevator that is also used to carry freight.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: Include capacities, sizes, performances, operations, safety features, finishes, and similar information. Include product data for car enclosures; hoistway entrances; and operation, control, and signal systems.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, and large-scale details indicating service at each landing; machine room layout; coordination with building structure; relationships with other construction; and locations of equipment.

2. Include large-scale layout of car-control station[ and standby-power operation control panel].
  3. Indicate maximum dynamic and static loads imposed on building structure at points of support as well as maximum and average power demands.
- C. Samples for Verification: For exposed car, hoistway door and frame, and signal equipment finishes, 3-inch- square Samples of sheet materials and 4-inch lengths of running trim members.
- 1.5 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For Installer.
- 1.6 CLOSEOUT SUBMITTALS
- A. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.
1. Submit manufacturer's/installer's standard operation and maintenance manual, in accordance with ASME A17.1/CSA B44[ including diagnostic and repair information available to manufacturer's and Installer's maintenance personnel].
- B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.
- 1.7 QUALITY ASSURANCE
- A. Installer Qualifications: Elevator manufacturer or an authorized representative who is trained and approved by manufacturer.
- 1.8 DELIVERY, STORAGE, AND HANDLING
- A. Deliver, store, and handle materials, components and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.
- 1.9 COORDINATION
- A. Coordinate installation of sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.
- B. Coordinate locations and dimensions of other work specified in other Sections that relates to hydraulic elevators, including pit ladders; sumps and floor drains in pits; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways, pits, and machine rooms.

1.10 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
  - 2. Warranty Period: one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 HYDRAULIC ELEVATOR MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, Basis of Design; ThyssenKrupp Endura MRL or provide products by one of the following:
  - 1. KONE Inc.
  - 2. Schindler Elevator Corp.
- B. Source Limitations: Obtain elevators from single manufacturer.
  - 1. Major elevator components, including pump-and-tank units, plunger-cylinder assemblies, controllers, signal fixtures, door operators, car frames, cars, and entrances, shall be manufactured by single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with ASME A17.1/CSA B44.
- B. Accessibility Requirements: Comply with Section 407 in the United States Access Board's ADA-ABA Accessibility Guidelines and with ICC A117.1.

2.3 ELEVATORS

- A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturers' standard components shall be used, as included in standard elevator systems and as required for complete system.
- B. Elevator Description:
  - 1. Type: Holeless, beside-the-car, telescoping, dual cylinder.
  - 2. Rated Speed: 150 fpm.
  - 3. Operation System: Single automatic operation.

4. Auxiliary Operations:
  - a. Battery-powered lowering.
5. Security Features: Car-to-lobby feature.
6. Car Enclosures:
  - a. Dimensions: consistent with Basis of Design.
  - b. Car Fixtures: Satin stainless steel, No. 4 finish.
  - c. Side and Rear Wall Panels: Custom Plastic laminate.
  - d. Reveals: Enameled or powder-coated steel .
  - e. Door Faces (Interior): Satin stainless steel, No. 4 finish .
  - f. Door Sills: Aluminum.
  - g. Ceiling: Satin stainless steel, No. 4 finish.
  - h. Handrails: 1/2 by 2 inches rectangular , at sides and rear of car.
  - i. Floor prepared to receive carpet.
  - j. Include one set of wall protection pads.
7. Hoistway Entrances:
  - a. Dimensions: Consistent with Basis of Design.
  - b. Type: Single-speed side sliding.
  - c. Frames : Satin stainless steel, No. 4 finish.
  - d. Doors at First Floor: Satin stainless steel, No. 4 finish .
  - e. Doors at Other Floors: Satin stainless steel, No. 4 finish.
  - f. Sills : Aluminum.
8. Hall Fixtures : Satin stainless steel, No. 4 finish.
9. Additional Requirements:
  - a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, No. 4 finish.
  - b. Provide hooks for protective pads in all cars and one complete set(s) of full-height protective pads.

## 2.4 SYSTEMS AND COMPONENTS

- A. Pump Units: Positive-displacement type with a maximum of 10 percent variation between no load and full load and with minimum pulsations.
- B. Hydraulic Silencers: System shall have hydraulic silencer containing pulsation-absorbing material in blowout-proof housing at pump unit.
- C. Piping: Size, type, and weight of piping as recommended by elevator manufacturer, with flexible connectors to minimize sound and vibration transmissions from power unit.
- D. Hydraulic Fluid: Elevator manufacturer's standard [fire-resistant ]fluid with additives as needed to prevent oxidation of fluid, corrosion of cylinder and other components, and other adverse effects.

- E. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work. Device installation is specified in another Section.
- F. Car Frame and Platform: Welded or bolted steel units.
- G. Guides: Roller guides or sliding guides with guide-rail lubricators. Provide guides at top and bottom of car frame.

## 2.5 OPERATION SYSTEMS

- A. General: Provide manufacturer's standard microprocessor operation system as required to provide type of operation indicated.
- B. Auxiliary Operations:
  - 1. Single-Car Battery-Powered Lowering: If power fails and car is at a floor, it remains at that floor, opens its doors, and shuts down. If car is between floors, it is lowered to a preselected floor, opens its doors, and shuts down. If car is below the preselected floor, it is lowered to the next lower floor, opens its doors, and shuts down. System includes rechargeable battery and automatic recharging system.

## 2.6 DOOR-REOPENING DEVICES

- A. Infrared Array: Provide door-reopening device with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more light beams shall cause doors to stop and reopen.

## 2.7 CAR ENCLOSURES

- A. General: Provide steel-framed car enclosures with nonremovable wall panels, with removable car roof, access doors, power door operators, and ventilation.
  - 1. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.
- B. Materials and Finishes: Manufacturer's standards, but not less than the following:
  - 1. Plastic-Laminate Wall Panels: Plastic laminate adhesively applied to 1/2-inch fire-retardant-treated particleboard with plastic-laminate panel backing and manufacturer's standard protective edge trim. Panels have a flame-spread index of 25 or less, when tested according to ASTM E 84. Plastic-laminate color, texture, and pattern to be custom as selected by Architect.
  - 2. Light Fixture Efficiency: Not less than 35 lumens/W.
  - 3. Ventilation Fan Efficiency: Not less than 3.0 cfm/W.

## 2.8 HOISTWAY ENTRANCES

- A. Hoistway Entrance Assemblies: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile shall accommodate hoistway wall construction.
  - 1. Where gypsum board wall construction is indicated, frames shall be self-supporting with reinforced head sections.
- B. Fire-Rated Hoistway Entrance Assemblies: Door-and-frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as close-to-neutral pressure as possible according to NFPA 252 or UL 10B.

## 2.9 SIGNAL EQUIPMENT

- A. General: Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Provide[ vandal-resistant] buttons and lighted elements illuminated with LEDs.
- B. Car-Control Stations: Provide manufacturer's standard recessed car-control stations. Mount in return panel adjacent to car door unless otherwise indicated.
- C. Firefighters' Two-Way Telephone Communication Service: Provide telephone jack in each car and required conductors in traveling cable for firefighters' two-way telephone communication service specified in Section 28 4621.11 "Addressable Fire-Alarm Systems."
- D. Car Position Indicator: Provide illuminated, digital-type car position indicator, located above car door or above car-control station. Also, provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.
- E. Hall Push-Button Stations: Provide one hall push-button station at each landing.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Verify critical dimensions and examine supporting structure and other conditions under which elevator work is to be installed.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install cylinder plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor. Seal between casing and pit floor with 4 inches of nonshrink, nonmetallic grout.
- B. Install cylinder plumb and accurately centered for elevator car position and travel. Anchor securely in place, supported at pit floor and braced at intervals as needed to maintain alignment. Anchor cylinder guides at spacing needed to maintain alignment and avoid overstressing guides.
- C. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS workmanship and welding operator qualification standards.
- D. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.
- E. Lubricate operating parts of systems as recommended by manufacturers.
- F. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay installation of sills and frames until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.
- G. Leveling Tolerance: 1/4 inch, up or down, regardless of load and travel direction.
- H. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.
- I. Locate hall signal equipment for elevators as follows unless otherwise indicated:
  - 1. For groups of elevators, locate hall push-button stations between two elevators at center of group or at location most convenient for approaching passengers.
  - 2. Place hall lanterns either above or beside each hoistway entrance.
  - 3. Mount hall lanterns at a minimum of 72 inches above finished floor.

### 3.3 PROTECTION

- A. Temporary Use: Limit temporary use for construction purposes to one elevator. Comply with the following requirements for elevator used for construction purposes:
  - 1. Provide car with temporary enclosure, either within finished car or in place of finished car, to protect finishes from damage.
  - 2. Provide strippable protective film on entrance and car doors and frames.



3. Provide padded wood bumpers on entrance door frames covering jambs and frame faces.
4. Provide other protective coverings, barriers, devices, signs, and procedures as needed to protect elevator and elevator equipment.
5. Do not load elevators beyond their rated weight capacity.
6. Engage elevator Installer to provide full maintenance service. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleanup, and adjustment as necessary for proper elevator operation at rated speed and capacity. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
7. Engage elevator Installer to restore damaged work, if any, so no evidence remains of correction. Return items that cannot be refinished in the field to the shop, make required repairs and refinish entire unit, or provide new units as required.

#### 3.4 DEMONSTRATION

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

#### 3.5 MAINTENANCE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
  1. Perform maintenance during normal working hours.
  2. Perform emergency callback service during normal working hours with response time of two hours or less.

END OF SECTION 14 2400

## SECTION 21 0500 - WORK RESULTS FOR FIRE SUPPRESSION

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Pipe, fittings, sleeves, escutcheons, seals, and connections for sprinkler systems.

#### 1.2 RELATED REQUIREMENTS

- A. Section 07 8400 - Firestopping.
- B. Section 09 9123 - Interior Painting: Preparation and painting of interior fire protection piping systems.
- C. Section 22 0553 - Identification for Mechanical Piping and Equipment: Piping identification.
- D. Section 21 1300 - Fire-Suppression Sprinkler Systems: Sprinkler systems design.

#### 1.3 REFERENCE STANDARDS

- A. ASME A112.18.1 - Plumbing Supply Fittings; 2012.
- B. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; 2015.
- C. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2010.
- D. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2011.
- E. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2011.
- F. ASME B16.9 - Factory-Made Wrought Buttwelding Fittings; 2012.
- G. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.
- H. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- I. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe; 2009 (Reapproved 2014).
- J. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984 (Reapproved 2014).
- K. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use; 2013.
- L. ASTM B75/B75M - Standard Specification for Seamless Copper Tube; 2011.
- M. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2014.
- N. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2013.
- O. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops; 2013a.
- P. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40; 2015.
- Q. ASTM F439 - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80; 2013.

- R. ASTM F442/F442M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR); 2013.
- S. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings; 2014.
- T. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011-AMD 1.
- U. AWWA C606 - Grooved and Shouldered Joints; 2011.
- V. NFPA 13 - Standard for the Installation of Sprinkler Systems; 2016.
- W. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

#### 1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturers catalogue information. Indicate valve data and ratings.
- C. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.
- D. Project Record Documents: Record actual locations of components and tag numbering.
- E. Operation and Maintenance Data: Include installation instructions and spare parts lists.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified this section.
  - 1. Minimum five years experience.
- B. Conform to UL and FM requirements.
- C. Valves: Bear UL and FM label or marking. Provide manufacturer's name and pressure rating marked on valve body.
- D. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves in shipping containers, with labeling in place.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

### PART 2 PRODUCTS

#### 2.1 FIRE PROTECTION SYSTEMS

- A. Sprinkler Systems: Conform to NFPA 13.
- B. Welding Materials and Procedures: Conform to ASME BPVC-IX.

## 2.2 ABOVE GROUND PIPING

- A. Steel Pipe: ASTM A795 Schedule 10, ASTM A53 Schedule 40, or ASTM A135/A135M UL listed light wall type, black.
  - 1. Steel Fittings: ASME B16.9, wrought steel, butt welded.
  - 2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings and ASME B16.4, threaded fittings.
  - 3. Malleable Iron Fittings: ASME B16.3, threaded fittings.
  - 4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
- B. Copper Tube: ASTM B75/B75M or ASTM B88 (ASTM B88M), H58 drawn temper.
  - 1. Type: Type M (C).
  - 2. Fittings: ASME B16.18, cast copper alloy solder joint, pressure type.
  - 3. Joints: AWS A5.8M/A5.8 Classification BCuP-3 or BCuP-4 copper/silver braze.
- C. CPVC Pipe: ASTM F442/F442M, SDR 13.5.
  - 1. Fittings: ASTM F438 Schedule 40, or ASTM F439 schedule 80, CPVC.
  - 2. Joints: Solvent welded, using ASTM F493 cement.

## 2.3 PIPE SLEEVES

- A. Plastic, Sheet Metal, or Moisture-Resistant Fiber: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.
- B. Clearances:
  - 1. Provide allowance for insulated piping.
  - 2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
  - 3. All Rated Openings: Caulked tight with fire stopping material conforming to ASTM E814 in accordance with Section 07 8400 to prevent the spread of fire, smoke, and gases.

## 2.4 ESCUTCHEONS

- A. Material:
  - 1. Metals and Finish: Comply with ASME A112.18.1.
- B. Construction:
  - 1. One-piece for mounting on chrome-plated tubing or pipe and one-piece or split-pattern type elsewhere.
  - 2. Internal spring tension devices or setscrews to maintain a fixed position against a surface.

## 2.5 PIPE HANGERS AND SUPPORTS

- A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
- B. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.
- C. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
- D. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.
- E. Vertical Support: Steel riser clamp.

- F. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
- G. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

## 2.6 MECHANICAL COUPLINGS

- A. Rigid Mechanical Couplings for Grooved Joints:
  - 1. Dimensions and Testing: Comply with AWWA C606.
  - 2. Minimum Working Pressure: 300 psig.
  - 3. Housing Material: Fabricate of ductile iron conforming to ASTM A536.
  - 4. Housing Coating: Factory applied orange enamel.
  - 5. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
  - 6. Bolts and Nuts: Hot dipped galvanized or zinc electroplated steel.

## 2.7 FLEXIBLE SPRINKLER HEAD PIPING CONNECTIONS

- A. 304 stainless steel braided hose rated for 300 psi for use as required for concealed piping offsets for rigidly mounted sprinkler heads.
  - 1. Connections shall be FM approved and U.L. listed for suspended or sheetrock ceiling installations. Installation shall conform to requirements of NFPA 13.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and foreign material, from inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

### 3.2 INSTALLATION

- A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.
- B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.
- C. Install piping to conserve building space, to not interfere with use of space and other work.
- D. Group piping whenever practical at common elevations.
- E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- F. Inserts:
  - 1. Provide inserts for placement in concrete formwork.
  - 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
  - 3. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
  - 4. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

- G. Pipe Hangers and Supports:
  - 1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
  - 2. Place hangers within 12 inches of each horizontal elbow.
  - 3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
  - 4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
  - 5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
  - 6. Provide copper plated hangers and supports for copper piping.
- H. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
- I. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- J. Do not penetrate building structural members unless indicated.
- K. Provide sleeves when penetrating floors, walls, and partitions and seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required.
- L. Manufactured Sleeve-Seal Systems:
  - 1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
  - 2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
  - 3. Locate piping in center of sleeve or penetration.
  - 4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
  - 5. Tighten bolting for a water-tight seal.
  - 6. Install in accordance with manufacturer's recommendations.
- M. Escutcheons:
  - 1. Install and firmly attach escutcheons at piping penetrations into finished spaces.
  - 2. Provide escutcheons on both sides of partitions separating finished areas through which piping passes.
  - 3. Use chrome plated escutcheons in occupied spaces and to conceal openings in construction.
- N. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- O. Provide gate valves for shut-off or isolating service. Install valves with stems upright or horizontal.
- P. Provide drain valves at main shut-off valves, low points of piping and apparatus.

END OF SECTION 21 0500

## SECTION 21 1300 - FIRE-SUPPRESSION SPRINKLER SYSTEMS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Wet-pipe sprinkler system.
- B. System design, installation, and certification.
- C. Fire department connections.

#### 1.2 RELATED REQUIREMENTS

- A. Section 21 0500 - WORK RESULTS FOR FIRE SUPPRESSION: Pipe and fittings.
- B. Section 22 0548 - Vibration and Seismic Controls for Mechanical Piping and Equipment.
- C. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

#### 1.3 REFERENCE STANDARDS

- A. NFPA 13 - Standard for the Installation of Sprinkler Systems; 2016.
- B. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.
- C. UL 405 - Fire Department Connection Devices; Current Edition; Including All Revisions.

#### 1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.
- C. Shop Drawings:
  - 1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.
  - 2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls.
  - 3. Submit shop drawings to Authorities Having Jurisdiction for approval. Submit proof of approval to Engineer.
- D. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.
- E. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Sprinklers: Type and size matching those installed, in quantity required by referenced NFPA design and installation standard.
  - 3. Sprinkler Wrenches: For each sprinkler type.

## 1.5 QUALITY ASSURANCE

- A. Design system under direct supervision of a City licensed Fire Sprinkler Installer experienced in design of this type of work.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years experience and approved by manufacturer.
- C. Equipment and Components: Provide products that bear FM (AG) label or marking.
- D. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

## 1.7 EXTRA MATERIALS

- A. Provide extra sprinklers of type and size matching those installed, in quantity required by referenced NFPA design and installation standard.
- B. Provide suitable wrenches for each sprinkler type.
- C. Provide metal storage cabinet located adjacent to alarm valve.

# PART 2 PRODUCTS

## 2.1 MANUFACTURERS

- A. Sprinklers, Valves, and Equipment:
- B. Reliable Sprinkler.
- C. Viking Sprinkler.

## 2.2 SPRINKLER SYSTEM

- A. Sprinkler System: Provide coverage for entire building.
- B. Occupancy: Light hazard; comply with NFPA 13 for all areas.
- C. Water Supply: Determine volume and pressure from water flow test data.
- D. Interface system with building fire and smoke alarm system.
- E. Provide fire department connections where indicated.
- F. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

## 2.3 SPRINKLERS

- A. Suspended Ceiling and Gypsum Board Ceiling Type: Concealed pendant type with matching push on escutcheon plate.
  - 1. Finish: Enamel, color white.
  - 2. Cover plate Finish: Enamel, color: white.
  - 3. Fusible Link: Glass bulb type temperature rated for specific area hazard.
- B. Exposed Area Type: Standard upright type .
  - 1. Finish: Chrome plated.
  - 2. Fusible Link: Glass bulb type temperature rated for specific area hazard.



- C. Sidewall Type: Semi-recessed horizontal sidewall type with matching push on escutcheon plate .
  - 1. Finish: Chrome plated.
  - 2. Escutcheon Plate Finish: Chrome plated.
  - 3. Fusible Link: Glass bulb type temperature rated for specific area hazard.
- D. Guards: Finish to match sprinkler finish.

#### 2.4 PIPING SPECIALTIES

- A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate water motor alarm , with pressure retard chamber and variable pressure trim; with test and drain valve.
- B. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.
- C. Fire Department Connections:
  - 1. Type: Exposed, projected wall mount made of corrosion resistant metal with chrome finish complying with UL 405.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

- A. Install in accordance with referenced NFPA design and installation standard.
- B. Sprinkler coverage shall include all floor areas of the facility.
- C. Install equipment in accordance with manufacturer's instructions.
- D. Provide approved double check backflow preventer assembly at sprinkler system water source connection.
- E. Place pipe runs to minimize obstruction to other work.
- F. Place piping in concealed spaces above finished ceilings.
- G. Center sprinklers in two directions in ceiling tile and provide piping offsets as required.
- H. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.
- I. Flush entire piping system of foreign matter.
- J. Provide concealed type sprinkler heads with paintable covers in bulkhead locations and in gyp board ceilings in the entry areas and corridors on each floor.
- K. Install guards on sprinklers in storage rooms and mechanical and electrical equipment rooms and data closets.
- L. Provide 250 deg.F sprinkler heads in mechanical and electrical equipment rooms and data closets.
- M. Hydrostatically test entire system.
- N. Require test be witnessed by Fire Marshal.
- O. Install tamper supervisory switches in shut off valves (including post indicator valve) as required.

- P. Install water flow switches in locations as shown in drawings with indicator light for visual identification of flow switch activation.

### 3.2 INTERFACE WITH OTHER PRODUCTS

- A. Ensure required devices are installed and connected as required to fire alarm system.

END OF SECTION 21 1300

## SECTION 22 0050 - GENERAL PLUMBING PROVISIONS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. The work required under Plumbing Contract shall include all material, labor, equipment and services necessary and reasonably incidental to the proper completion of the systems, and all special work as hereinafter specified and indicated on the drawings.
- B. All work shall be executed in such a manner as to interfere as little as possible with the normal functioning of the facility, including operations of all utility services and any equipment, and with work being done by others. Roads shall be kept clear of materials, etc., at all times so that there will be no interference with the usual traffic. Where necessary, on account of new work connecting to existing pipes, where utility services are required to be cut, they shall be cut and capped at suitable places where indicated by drawings, or in the absence of such indication, where directed by the Architect/Engineer. No road traffic or utility service such as water, gas, or sewer shall be interrupted without prior approval of the Owner, and all arrangements for work which will involve such interference shall be made in advance with the Owner so that same can be effected in a minimum of time and interference.

#### 1.2 RELATED SECTIONS

- A. Section 01 0000 - General Requirements
- B. Section 00 7200 - General Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.
- C. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- D. Section 01 7000 - Execution and Closeout Requirements: Contract closeout procedures.
- E. Individual Product Sections: Specific requirements for operation and maintenance data.
- F. Individual Product Sections: Warranties required for specific products or Work.

#### 1.3 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS

- A. Drawings and specifications shall be taken together. Provide work specified and not indicated, or work indicated and not specified as though mentioned in both.
- B. In case of discrepancy between drawings and specifications, or within either document, the greater quantity of work and/or better quality shall be used for estimating and the matter brought to the Architect/Engineer's attention for a written decision.
- C. Drawings are to be interpreted as diagrammatic only, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment. It should be understood that the Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pipes and ducts so as to best fit the layout of the job. Scaling of the drawings will not be sufficient or accurate for determining these locations. Contractor shall refer to the Architectural drawing for dimensions of walls, foundations, structural beams, and other structural building members. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.

- D. Because of the scale of the drawings, certain basic items, such as fittings, boxes, valves, unions, etc., may not be shown, but where such items are required by other sections of the specifications or where they are required for proper installation of the work, such items shall be furnished and installed.
- E. The determination of quantities of material and equipment required shall be made by the Contractor from the drawings. Schedules on the drawings and in the specifications are completed as an aid to the Contractor but where discrepancies arise, the greater number shall govern.
- F. Where words "provide", "install", or "furnished" are used on the drawings or in the specifications, it shall be taken to mean, to furnish, install and connect up complete and ready for operation, the items mentioned.

#### 1.4 COOPERATION AND PROGRESS

- A. Keep informed about the work of all other trades engaged in the project and execute the work in such a manner as not to delay or interfere with the progress of other contractors. This contractor shall schedule his work so that no other contractor is delayed in the execution of his work. Complete cooperation of all trades is expected. Employ a competent foreman on job throughout the entire project to ensure that coordination is maintained.
- B. Schedule and coordinate the work of this Division with the schedule of the contractor to progress the work expeditiously, and to avoid unnecessary delays.
- C. Examine fully the drawings and specifications for other contractors for other trades, and coordinate the installation of this work with the work of the other contractors. Consult and cooperate with other contractors for determining space requirements and for determining that adequate clearance is allowed with respect to his equipment, other equipment, and the building. The Owner's representative reserves the right to determine space priority in the event of interference between piping, conduit, ducts, and equipment of the various contractors.
- D. Conflicts between the drawings and the specification shall be called to the attention of the Owner's representative and Architect/Engineer. If clarification is not asked for prior to the taking of bids, it will be assumed that none is required and that the contractor is in agreement with the drawings and specifications as issued. If clarification is required after the Contract is awarded, such clarification will be made by the Architect/Engineer and his decision will be final.
- E. Coordinate the installation of all mechanical system components with all other trades, including structural components and electrical trades. Allocate space in the different areas to allow for the installation of ductwork, piping, sprinklers, waste and vents, and mechanical equipment above ceilings and in equipment spaces. Recommend rerouting, resizing or relocation of mechanical components, if necessary, so all trades can install their systems in the space allotted. Any proposed changes from the systems layout, on the drawings, shall be done in accordance with the design criteria specified in the applicable codes and shall be subject to the review and acceptance of the Architect/Engineer.
- F. After award of the Contract, and prior to start of construction, the General Contractor shall schedule a meeting with the contractor and all subcontractors responsible of the work items listed above. The purpose of the meeting is to introduce the coordination program and to determine its implementation in relation to the progress schedule.

- G. All contractors and subcontractors shall participate in the coordination process. Participation is mandatory. If a contractor or subcontractor fails to participate in the coordination process, the Owner reserves the right to do the following:
    - 1. Stop any and all construction progress payments for any work performed by the contractor. Such payments will be reinstated only after the contractor or subcontractor resumes participation in the coordination drawing process.
    - 2. Relocate and resize contractor's work components as necessary to ensure all components will be installed as intended. In the event the contractor did not participate in the coordination process, he will not be entitled to any contract cost increases or time extensions due to Owner initiated changes in the work.
  - H. The contractor shall also be held responsible for any unnecessary rework by other trade contractors that is attributable to his failure to participate in the coordination process.
  - I. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility because of the scale of the drawings. Each contractor is expected to have included in his bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process. The contractor will not be allowed any contract cost extra or time extension for changes dictated by the coordination process.
  - J. Utility installation in congested areas is dependent on the sequence of utility installation as much as it is dependent on the physical size of the utilities. The contractors shall use the coordination process to properly sequence the installation of utilities as appropriate to ensure the above ceiling and congested area utility installation is satisfactory.
- 1.5 GUARANTEE
- A. The Contractor, by the acceptance of this specification and the signing of the Contract, acknowledges his acquaintance with all the requirements and guarantees that every part going to make up the system, will be the best of its respective kind and will be erected in a most thorough and substantial manner by none but experienced labor.
  - B. The Contractor guarantees that all piping as provided in this specification will be free from all obstructions, and that all piping will be tight and drip free.
  - C. The Contractor guarantees that, in the entire domestic water system, a continuous and noiseless circulation of water will be established to all fixtures; and that water may be drawn from any fixture without hammering.
  - D. The Contractor guarantees that all equipment and appliances will successfully and acceptably perform the work for which they are installed and that each will operate smoothly and quietly up to its rated capacity.
  - E. The Contractor further guarantees himself responsible for any defects which may develop in any part of the system, including equipment, piping, fixtures and appliances, due to faulty workmanship, design or material; and to replace and make good, without cost to the Owner, any such faulty parts or construction which develop defects at any time within one (1) year from the date of substantial completion. The date of substantial completion shall be as defined in the Contract Documents. Any repairs or replacement required on account of defects, as outlined in this paragraph shall be made promptly upon written notice from the Architect.
  - F. Natural wear, accident, or carelessness on the part of others, however, shall not be made good by the Contractor.

1.6 PROTECTION OF INSTALLED WORK AND MATERIAL STORED ON SITE

- A. The Contractor is responsible for all work installed by him until his contract is complete and shall protect it from injury by others.
- B. All piping, fittings, equipment and material to be stored on the jobsite for any period of time shall be protected from the weather in a manner that is acceptable to the Architect.

1.7 SITE VISIT

- A. Bidders are advised to visit the site and inform themselves as to all conditions, and failure to do so will in no way relieve the successful bidder from the necessity of furnishing any material or performing any work that may be required to complete the work in accordance with the true intent and meaning of the drawings and specifications without additional cost to the Owner.
- B. Before bidding the job, investigate, determine and verify locations and invert elevations of sanitary and storm sewers, city water mains and any other buried or overhead utilities on or near site. Determine such locations in conjunction with all public and private utility companies and with all authorities having jurisdiction.
- C. On projects where remodeling of an existing structure is in the scope of the project, the contractor shall field verify locations of existing piping and ductwork. The contractor shall verify the exact locations of existing piping and ductwork to which the new ductwork and new piping are to connect and if the locations of the existing piping and ductwork are different than that shown on the drawings, the contractor shall include the additional cost in his bid proposal. The contractor shall also field verify the locations of existing piping and ductwork that are in conflict with the routing of the new work, and include in his bid proposal monies for the rerouting of the existing work in order to accommodate the new work.

1.8 RULES, REGULATIONS AND CODES

- A. The Contractor shall become acquainted with the local codes, and in case of a discrepancy between plans or specifications and the local codes, the Contractor shall use the code requirements. The greater quantity of work and material and/or better quality shall be used for estimating and the matter brought to the Architect's attention for a written decision.
- B. Perform all work in strict accordance with all rules, regulations, codes, ordinances, or laws of Local, State, and Federal governments, or of other authorities having lawful jurisdiction. Comply therewith. Such rules, regulations, codes, ordinances, or laws include, but are not necessarily limited to, the following:
  - 1. State building and fire codes.
  - 2. State plumbing and mechanical codes.
  - 3. City building and fire codes.
  - 4. City plumbing and mechanical codes.
  - 5. American Gas Association.
  - 6. National Electric Code.
  - 7. National Fire Protection Association.
  - 8. Occupation Safety and Health Act.
- C. If the Contractor notes, at the time of bidding, any parts of the plans and specifications which are not in accord with the applicable codes or regulations, he shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time to

follow this procedure, he shall submit with his proposal a separate price required to make the system shown on the drawings comply with the codes and regulations.

- D. All changes to the system made after the letting of the contract, in order to comply with the applicable codes or the requirements of the inspector, shall be made by the Contractor without cost to the Owner.

#### 1.9 SUBSTITUTIONS

- A. The Architect/Engineer shall be the sole and final judge as to the suitability of items substituted for those specified.
- B. The entire cost of all changes of any type due to substitutions for materials specified shall be borne by the Contractor at no extra cost to the Owner.
- C. Unsolicited and voluntary deducts, on the part of the Contractor for substituting unapproved equipment, shall not be considered for the purpose of awarding the Contract.
- D. When the drawings and/or specifications refer to any item, article, material, method, fabrication, assembly or construction by means of one or more manufacturer's trade name, catalog reference or similar means of identification of manufacturer, the Contractor shall furnish one of the makes so identified without substitution unless other make or makes have been approved by addendum to the contract documents prior to the receipt of bids. Requests for the approval of items of equal quality are requested to be made in writing to the Architect/Engineer five days prior to the date of the receipt of bids so that a list of acceptable equal quality items can be made known to all bidders by an addendum. If substitution for names items, articles, materials, methods, fabrications, assembly or construction are approved, the Contractor assumes all responsibility for coordination and performing the related changes in the work necessitated by such substitutions and shall include in his bid all costs involved therein.

#### 1.10 SHOP DRAWING REVIEW

- A. Shop drawings will be reviewed only to extent of information indicated. This check is only for review of general conformance with the design concept of the project and general compliance with the information given the contract documents. The contractor is responsible for confirming and correlating all quantities and dimensions, selecting fabrication processes techniques of construction, coordinating his work in a safe and satisfactory manner.
- B. Review of shop drawings shall not relieve Contractor of responsibility for providing all controls, wiring, components, etc., which are shown or specified, or all additional controls, wiring, components, etc., required to provide complete and correctly operating mechanical systems.
- C. In cases where substituted equipment has been installed in place of specified equipment the Contractor shall bear the entire cost of all changes of any type due to the substitution, even though the shop drawings have been reviewed by the Architect/Engineer.
- D. Shop drawings in no way relieve the contractor from performing on the job as to the intent of the construction documents.

#### 1.11 CONNECTING NEW WORK TO EXISTING WORK

- A. Connect new work to existing work in a neat workmanlike manner. In every case where any part of the existing work must be cut to install new work, or is damaged, same must

be patched and repaired in a manner satisfactory to the Architect. Where relocation of existing equipment and piping systems is necessary in areas providing uninterruptible services, schedule work during slack periods. Anticipate scheduling work at a period which will result in additional construction cost, such as overtime for work to be done at night or on weekends. Include cost in the bid proposal.

- B. Do not cut into existing services without first informing the Owners representative as to the time and duration of shutdown of the existing services.
- C. Perform work that interrupts any service at a time that will cause least interference to the operation of the building.
- D. Maintain all existing services and equipment unless indicated to be removed.

#### 1.12 ACCESS TO EQUIPMENT FOR MAINTENANCE

- A. Install all equipment, piping, etc., to permit access for normal maintenance. Maintain easy access to filters, motors, drive compressors, coils, etc. Install all such equipment and accessories to facilitate maintenance. Perform any relocation of pipes, ducts, etc. required to permit access at request of Architect/Engineer at no additional cost to Owner.

#### 1.13 FIRE AND SMOKE STOPPAGE

- A. It shall be the responsibility of this Contractor to maintain and fire and smoke integrity of all walls, ceilings, floors, etc., through which this work passes through or into. Fire and smoke barriers shall be provided in and around as required by Codes.
- B. Where holes are required to be patched, or conduit, piping, ducts, etc., are required to be patched around, it shall be filled with a material that is UL Classified Standard 1479 for this use and Factory Mutual System approved.
- C. Fire and smoke stoppage material shall be water based with intumescent properties. Material may be in the form of caulking, putty pads or wrap strips. Materials shall be installed in accordance to manufacturers and UL standards.

#### PART 2 PRODUCTS - NOT USED

#### PART 3 EXECUTION - NOT USED

END OF SECTION 22 0050



## SECTION 22 0501 - CLOSEOUT SUBMITTALS FOR PLUMBING

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Project Record Documents.
- B. Operation and Maintenance Data.

#### 1.2 RELATED SECTIONS

- A. Section 00 7200 - General Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.
- B. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- C. Individual Product Sections: Specific requirements for operation and maintenance data.
- D. Individual Product Sections: Warranties required for specific products or Work.

#### 1.3 SUBMITTALS

- A. Project Record Documents: Submit documents to Engineer.
- B. Operation and Maintenance Data:
  - 1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Engineer will review draft and return one copy with comments.
  - 2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
  - 3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Engineer comments. Revise content of all document sets as required prior to final submission.
  - 4. Submit two sets of revised final documents in final form within 10 days after final inspection.
- C. Warranties and Bonds:
  - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
  - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
  - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

### 3.1 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
  - 1. Drawings.
  - 2. Addenda.
  - 3. Change Orders and other modifications to the Contract.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Record Drawings : Legibly mark each item to record actual construction including:
  - 1. Field changes of dimension and detail.

### 3.2 OPERATION AND MAINTENANCE DATA

- A. For Each Product or System: List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

### 3.3 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
  - 1. Description of unit or system, and component parts.
  - 2. Identify function, normal operating characteristics, and limiting conditions.
  - 3. Include performance curves, with engineering data and tests.
  - 4. Complete nomenclature and model number of replaceable parts.
- B. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- C. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- D. Provide servicing and lubrication schedule, and list of lubricants required.
- E. Include manufacturer's printed operation and maintenance instructions.
- F. Include sequence of operation by controls manufacturer.
- G. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

- H. Provide control diagrams by controls manufacturer as installed.
- I. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
- J. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- K. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- L. Include test and balancing reports.
- M. Additional Requirements: As specified in individual product specification sections.

### 3.4 OPERATION AND MAINTENANCE MANUALS

- A. Prepare instructions and data by personnel experienced in maintenance and operation of described products.
- B. Prepare data in the form of an instructional manual.
- C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- E. Provide tabbed dividers for each separate product and system, with typed description of product and major component parts of equipment.
- F. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
  - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Engineer, Contractor, Subcontractors, and major equipment suppliers.
  - 2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
    - a. Significant design criteria.
    - b. List of equipment.
    - c. Parts list for each component.
    - d. Operating instructions.
    - e. Maintenance instructions for equipment and systems.
  - 3. Part 3: Project documents and certificates, including the following:
    - a. Shop drawings and product data.
    - b. Air and water balance reports.
    - c. Photocopies of warranties and bonds.

END OF SECTION 22 0501

## SECTION 22 0502 - DEMONSTRATION AND TRAINING FOR PLUMBING SYSTEMS

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Demonstration of products and systems where indicated in specific specification sections.
- B. Training of Owner personnel in operation and maintenance is required for:
  - 1. Plumbing equipment.

#### 1.2 RELATED SECTIONS

- A. Section 220501 - Closeout Submittals: Operation and maintenance manuals.
- B. Other Specification Sections: Additional requirements for demonstration and training.

#### 1.3 SUBMITTALS

- A. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
  - 1. Include applicable portion of O&M manuals.
  - 2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
  - 3. Provide one extra copy of each training manual to be included with operation and maintenance data.
- B. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.
  - 1. Format: DVD Disc.
  - 2. Label each disc and container with session identification and date.

#### 1.4 QUALITY ASSURANCE

- A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
  - 1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
  - 2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

### PART 2 PRODUCTS - NOT USED

### PART 3 EXECUTION

#### 3.1 DEMONSTRATION - GENERAL

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.
- B. Demonstration may be combined with Owner personnel training if applicable.
- C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
  - 1. Perform demonstrations not less than two weeks prior to Substantial Completion.

2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
  - D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
    1. Perform demonstrations not less than two weeks prior to Substantial Completion.
- 3.2 TRAINING - GENERAL
- A. Conduct training on-site unless otherwise indicated.
  - B. Provide training in minimum two hour segments.
  - C. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
    1. The location of the O&M manuals and procedures for use and preservation; backup copies.
    2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
    3. Typical uses of the O&M manuals.
  - D. Product- and System-Specific Training:
    1. Review the applicable O&M manuals.
    2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
    3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
    4. Provide hands-on training on all operational modes possible and preventive maintenance.
    5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
    6. Discuss common troubleshooting problems and solutions.
    7. Discuss any peculiarities of equipment installation or operation.
    8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
    9. Review recommended tools and spare parts inventory suggestions of manufacturers.
    10. Review spare parts and tools required to be furnished by Contractor.
    11. Review spare parts suppliers and sources and procurement procedures.
  - E. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION 22 0502

## SECTION 22 0513 - COMMON MOTOR REQUIREMENTS FOR MECHANICAL EQUIPMENT

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. General construction and requirements.
- B. Applications.
- C. Single phase electric motors.
- D. Three phase electric motors.

#### 1.2 RELATED REQUIREMENTS

- A. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

#### 1.3 REFERENCE STANDARDS

- A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015.
- B. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; 2004.
- C. NEMA MG 1 - Motors and Generators; 2014.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

#### 1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.
- C. Operation Data: Include instructions for safe operating procedures.
- D. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

#### 1.5 QUALITY ASSURANCE

- A. Conform to NFPA 70.

### PART 2 PRODUCTS

#### 2.1 GENERAL CONSTRUCTION AND REQUIREMENTS

- A. Nominal Efficiency:
  - 1. NEMA Premium motors with efficiencies outlined in MG 1 Table 12.
- B. Construction:
  - 1. Open drip-proof type except where specifically noted otherwise.
  - 2. Design for continuous operation in 104 degrees F environment.
  - 3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.

- C. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.
- D. Wiring Terminations:
  - 1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
  - 2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

## 2.2 APPLICATIONS

### 2.3 THREE PHASE POWER - SQUIRREL CAGE MOTORS

- A. Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B motors.
- B. Insulation System: NEMA Class B or better.
- C. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
- D. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
- E. Sound Power Levels: To NEMA MG 1.
- F. Nominal Efficiency: As indicated at full load and rated voltage when tested in accordance with IEEE 112.
- G. Nominal Power Factor: As indicated at full load and rated voltage when tested in accordance with IEEE 112.
- H. NEMA Open Motor Service Factor: A minimum of 1.15.

END OF SECTION 22 0513

## SECTION 22 0516 - EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Flexible pipe connectors.
- B. Expansion joints and compensators.

#### 1.2 RELATED REQUIREMENTS

- A. Section 22 1005 - Plumbing Piping.
- B. Section 23 2113 - Hydronic Piping.

#### 1.3 REFERENCE STANDARDS

- A. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2010.
- B. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard; 2013.
- C. ASME B16.11 - Forged Fittings, Socket-welding and Threaded; 2011.

#### 1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data:
  - 1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
  - 2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

### PART 2 PRODUCTS

#### 2.1 FLEXIBLE PIPE CONNECTORS - STEEL PIPING

- A. Manufacturers:
  - 1. The Metraflex Company: [www.metralflex.com/#sle](http://www.metralflex.com/#sle).
  - 2. Substitutions: See Section 01 6000 - Product Requirements.
- B. Inner Hose: Carbon steel.
- C. Exterior Sleeve: Single braided, stainless steel.

#### 2.2 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

- A. Manufacturers:
  - 1. The Metraflex Company: [www.metralflex.com/#sle](http://www.metralflex.com/#sle).
- B. Inner Hose: Bronze.
- C. Exterior Sleeve: Braided bronze.



2.3 EXPANSION JOINTS - STAINLESS STEEL BELLOWS TYPE

- A. Manufacturers:
  - 1. The Metraflex Company: [www.metralflex.com/#sle](http://www.metralflex.com/#sle).
- B. Maximum Compression: 1-3/4 inches.
- C. Maximum Extension: 1/4 inch.
- D. Size: Use pipe sized units.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

END OF SECTION 22 0516

## SECTION 22 0519 - METERS AND GAGES FOR MECHANICAL PIPING

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Pressure gages and pressure gage taps.
- B. Thermometers and thermometer wells.

#### 1.2 RELATED REQUIREMENTS

#### 1.3 REFERENCE STANDARDS

- A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2013.
- B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014.
- C. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

#### 1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

### PART 2 PRODUCTS

#### 2.1 PRESSURE GAGES

- A. Manufacturers:
  - 1. Dwyer Instruments, Inc.
  - 2. Trerice.
  - 3. Weiss.
- B. Pressure Gages: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.
  - 1. Case: Cast aluminum with phosphor bronze bourdon tube.
  - 2. Size: 4-1/2 inch diameter.
  - 3. Size: 3-1/2 inch diameter.
  - 4. Mid-Scale Accuracy: One percent.
  - 5. Scale: Psi and kPa.
  - 6. Provide liquid filled gages for pump installations to dampen vibration.

#### 2.2 PRESSURE GAGE TAPPINGS

- A. Gage Cock: Tee or lever handle, brass for maximum 150 psi.

#### 2.3 DIAL THERMOMETERS

- A. Manufacturers:
  - 1. Dwyer Instruments, Inc.
  - 2. Trerice.
  - 3. Weiss.

- B. Thermometers - Adjustable Angle: Dial type bimetallic actuated; ASTM E1; stainless steel case, adjustable angle with front recalibration, silicone fluid damping, white with black markings and black pointer, hermetically sealed lens, stainless steel stem.
  - 1. Size: 5 inch diameter dial.
  - 2. Size: 3 inch diameter dial.
  - 3. Lens: Clear Lexan.
  - 4. Accuracy: 1 percent.
  - 5. Calibration: Degrees F.

#### 2.4 THERMOMETER SUPPORTS

- A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide one pressure gage per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gage.
- C. Install pressure gages with pulsation dampers. Provide gage cock to isolate each gage. Extend nipples and siphons to allow clearance from insulation. Provide siphon on gages in steam systems.
- D. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.
- E. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets. Refer to Section 23 0943. Where thermometers are provided on local panels, duct or pipe mounted thermometers are provided on local panels, duct or pipe mounted thermometers are not required.
- F. Locate duct mounted thermometers minimum 10 feet downstream of mixing dampers, coils, or other devices causing air turbulence.
- G. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- H. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- I. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

END OF SECTION 22 0519

SECTION 22 0548 - VIBRATION AND SEISMIC CONTROLS FOR MECHANICAL PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Roof curbs.
- B. Vibration isolators.

1.2 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data:

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Mason Industries.
- B. Vibration Mountings and Controls.

2.2 PERFORMANCE REQUIREMENTS

- A. General:
  - 1. All vibration isolators, base frames and inertia bases to conform to all uniform deflection and stability requirements under all operating loads.

2.3 ROOF CURBS

- A. Vibration Isolation Curbs:
  - 1. Non-Seismic Curb:
    - a. Location: Between structure and rooftop equipment.
    - b. Construction: Aluminum.
    - c. Integral vibration isolation to conform to requirements of this section.
    - d. Weather exposed components consist of corrosion resistant materials.

2.4 VIBRATION ISOLATORS

- A. Restrained Open Spring Isolators:
  - 1. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection. Color code springs for load carrying capacity.
  - 2. Spring Mounts: Provide with leveling devices, minimum 0.25 inch thick neoprene sound pads, and zinc chromate plated hardware.
  - 3. Sound Pads: Size for minimum deflection of 0.05 inch; meet requirements for neoprene pad isolators.
  - 4. Restraint: Provide heavy mounting frame and limit stops.
- B. Neoprene Pad Isolators:
  - 1. Rubber or neoprene waffle pads.
    - a. Thickness: Minimum 1/2 inch.
  - 2. Configuration: Single layer.

- C. Rubber Mount or Hanger: Molded rubber designed for 0.4 inch deflection with threaded insert.

### PART 3 EXECUTION

#### 3.1 INSTALLATION - GENERAL

- A. Install in accordance with manufacturer's instructions.
- B. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.
- C. Install all vertical furnaces on neoprene pad isolators and horizontal heat pumps hung with spring isolators.
- D. Compressors and blowers in air handling equipment shall be mounted with spring isolators and flexible duct connections shall be provided.

END OF SECTION 22 0548

## SECTION 22 0553 - IDENTIFICATION FOR MECHANICAL PIPING AND EQUIPMENT

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe markers.
- D. Ceiling tacks.

#### 1.2 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2007.

#### 1.3 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Product Data: Provide manufacturers catalog literature for each product required.
- E. Project Record Documents: Record actual locations of tagged valves.

### PART 2 PRODUCTS

#### 2.1 IDENTIFICATION APPLICATIONS

- A. Roof Top Unit: Nameplates.
- B. Furnace and Heat Pumps: Nameplates.
- C. Mini-split (indoor and outdoor): Nameplates.
- D. Air Terminal Units: Tags.
- E. Automatic Controls: Tags. Key to control schematic.
- F. Control Panels: Nameplates.
- G. Dampers: Ceiling tacks, where located above lay-in ceiling.
- H. Ductwork: Nameplates.
- I. Heat Transfer Equipment: Nameplates.
- J. Instrumentation: Tags.
- K. Major Control Components: Nameplates.
- L. Piping: Pipe markers.
- M. Pumps: Nameplates.

- N. Small-sized Equipment: Tags.
- O. Tanks: Nameplates.
- P. Thermostats: Nameplates.
- Q. Valves: Tags and ceiling tacks where located above lay-in ceiling.
- R. Water Treatment Devices: Nameplates.

## 2.2 NAMEPLATES

- A. Description: Laminated three-layer plastic with engraved letters.
  - 1. Letter Color: White.
  - 2. Letter Height: 1/4 inch.
  - 3. Background Color: Black.

## 2.3 TAGS

- A. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
- B. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

## 2.4 PIPE MARKERS

- A. Comply with ASME A13.1.
- B. Plastic Pipe Markers: Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
- D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

## 2.5 CEILING TACKS

- A. Description: Steel with 3/4 inch diameter color coded head.

# PART 3 EXECUTION

## 3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

## 3.2 INSTALLATION

- A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install plastic pipe markers in accordance with manufacturer's instructions.
- C. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- D. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

- E. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
- F. Identify control panels and major control components outside panels with plastic nameplates.
- G. Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 3/4 inch diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

### 3.3 SCHEDULES

#### A. Piping:

1.	Domestic Cold Water	Light Blue	DCW
2.	Domestic Hot Water	Blue	DHW
3.	Gas	Violet	G
4.	Storm Drains	Grey	ST
5.	Heating Water Supply	Maroon	HWS
6.	Heating Water Return	Maroon	HWR

END OF SECTION 22 0553



## SECTION 22 0716 - MECHANICAL EQUIPMENT INSULATION

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Equipment insulation.
- B. Covering.

#### 1.2 RELATED REQUIREMENTS

- A. Section 23 2113 - Hydronic Piping: Placement of hangers and hanger inserts.
- B. Section 23 2114 - Hydronic Specialties.

#### 1.3 REFERENCE STANDARDS

- A. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2014.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- C. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

#### 1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum 5 years of experience.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

### PART 2 PRODUCTS

#### 2.1 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

#### 2.2 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturer:
  - 1. Armacell International; Model Armaflex.
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 3, in sheet form.
  - 1. Minimum Service Temperature: Minus 40 degrees F.
  - 2. Maximum Service Temperature: 220 degrees F.
  - 3. Connection: Waterproof vapor barrier adhesive.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that equipment has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

### 3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
- C. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.
- D. Insulated equipment containing fluids below ambient temperature: Insulate entire system.
- E. For hot equipment containing fluids 140 degrees F or less, do not insulate flanges and unions, but bevel and seal ends of insulation.
- F. For hot equipment containing fluids over 140 degrees F, insulate flanges and unions with removable sections and jackets.
- G. Inserts and Shields:
  - 1. Application: Equipment 1-1/2 inches diameter or larger.
  - 2. Shields: Galvanized steel between hangers and inserts.
  - 3. Insert location: Between support shield and equipment and under the finish jacket.
  - 4. Insert configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
- H. Cover glass fiber insulation with metal mesh and finish with heavy coat of insulating cement.
- I. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.
- J. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

### 3.3 SCHEDULES

- A. Heating Systems:
  - 1. Pump Bodies:
    - a. Cellular Foam Insulation: 1-1/2 inches thick.
  - 2. Air Separators:
    - a. Cellular Foam Insulation: 1-1/2 inches thick.
  - 3. Hot Thermal Storage Tanks: 1-1/2 inches thick.

END OF SECTION 22 0716

## SECTION 22 0719 - MECHANICAL PIPING INSULATION

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Piping insulation.
- B. Jackets and accessories.

#### 1.2 RELATED REQUIREMENTS

- A. Section 07 8400 - Firestopping.
- B. Section 22 1005 - Plumbing Piping: Placement of hangers and hanger inserts.
- C. Section 23 2113 - Hydronic Piping: Placement of hangers and hanger inserts.

#### 1.3 REFERENCE STANDARDS

- A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.
- B. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2014.
- C. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2015.
- D. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.
- E. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2013).
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- G. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.
- H. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

#### 1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

#### 1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum 5 years of experience.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

## 1.7 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

## PART 2 PRODUCTS

### 2.1 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

### 2.2 GLASS FIBER

- A. Manufacturers:
  - 1. Johns Manville Corporation: [www.jm.com](http://www.jm.com).
  - 2. Knauf Insulation: [www.knaufusa.com](http://www.knaufusa.com).
  - 3. Owens Corning Corp: [www.owenscorning.com](http://www.owenscorning.com).
- B. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
  - 1. 'K' Value: ASTM C177, 0.24 at 75 degrees F.
  - 2. Maximum Service Temperature: 650 degrees F.
  - 3. Maximum Moisture Absorption: 0.2 percent by volume.
- C. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.
- D. Vapor Barrier Lap Adhesive: Compatible with insulation.

### 2.3 FLEXIBLE REMOVEABLE AND REUSABLE BLANKET INSULATION

- A. Insulation: ASTM C553 Type V; flexible, noncombustible.

### 2.4 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

- A. Manufacturer:
  - 1. Armacell LLC.
  - 2. Rubatex Corp.
- B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.
  - 1. Minimum Service Temperature: Minus 40 degrees F.
  - 2. Maximum Service Temperature: 220 degrees F.
  - 3. Connection: Waterproof vapor barrier adhesive.
- C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

### 2.5 JACKETS

- A. PVC Plastic.
  - 1. Manufacturers:
    - a. Johns Manville Corporation: [www.jm.com](http://www.jm.com).
    - b. Proto Corp.: Model Proto Lo Smoke
  - 2. Jacket: One piece molded type fitting covers and sheet material, off-white color.
    - a. Minimum Service Temperature: 0 degrees F.
    - b. Maximum Service Temperature: 150 degrees F.

- c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
- d. Thickness: 10 mil.
- e. Connections: Brush on welding adhesive.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

#### 3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide insulation thicknesses which comply with current adopted version of the International Energy Conservation Code.
- C. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.
- D. Glass fiber insulated pipes conveying fluids below ambient temperature:
  - 1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
  - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- E. For hot piping conveying fluids over 120 degrees F, insulate flanges and unions at equipment.
- F. Glass fiber insulated pipes conveying fluids above ambient temperature:
  - 1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
  - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with PVC fitting covers.
- G. Insulate valves, strainers, flow control devices with removable insulation kits.
- H. Inserts and Shields:
  - 1. Application: Piping 1-1/2 inches diameter or larger.
  - 2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
  - 3. Insert Location: Between support shield and piping and under the finish jacket.
  - 4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
  - 5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- I. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 8400.

- J. Pipe Exposed in Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.
- K. Refrigerant piping exposed to the exterior shall be painted with a white latex paint.

### 3.3 SCHEDULES

#### A. Plumbing Systems:

- 1. Domestic Hot Water Supply and Hot Water Recirculation:
  - a. Glass Fiber Insulation:
    - 1) Pipe Size Range: Up to 1-1/2", 1 inch thickness.
    - 2) Pipe Size Range: 2" and over, 2 inch thickness.
- 2. Domestic Cold Water Supply Above Grade:
  - a. Glass Fiber Insulation:
    - 1) Pipe Size Range: All sizes, 1/2 inch thickness.
- 3. Domestic Hot and Cold Water Supply Below Grade:
  - a. Elastomeric Cellular Insulation:
    - 1) All sizes, 1/2 inch thickness.
- 4. Roof Drain Bodies and Roof Drainage Above Grade where interior:
  - a. Glass Fiber Insulation:
    - 1) Pipe Size Range: All sizes, 1 inch thickness.

#### B. Heating Systems:

- 1. Heating Water Supply and Return:
  - a. Glass Fiber Insulation:
    - 1) Pipe Size Range: Up to 1-1/2", 1-1/2 inch thickness.
    - 2) Pipe Size Range: 2" and over, 2 inch thickness.

#### C. Cooling Systems:

- 1. Condensate Drains from Cooling Coils:
  - a. Glass Fiber Insulation:
    - 1) All sizes, 1/2 inch thickness where concealed in a wall or ceiling space.
- 2. Refrigerant Suction:
  - a. Flexible Elastomeric Cellular Insulation:
    - 1) All sizes, 1-1/2 inch thickness.

END OF SECTION 22 0719

## SECTION 22 1005 - PLUMBING PIPING

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Pipe, pipe fittings, specialties, and connections for piping systems.
  - 1. Storm water.
  - 2. Flanges, unions, and couplings.
  - 3. Pipe hangers and supports.
  - 4. Valves.
  - 5. Check.

#### 1.2 RELATED REQUIREMENTS

- A. Section 09 9123 - Interior Painting.
- B. Section 22 0516 - Expansion Fittings and Loops for Plumbing Piping.
- C. Section 22 0548 - Vibration and Seismic Controls for Mechanical Piping and Equipment.
- D. Section 22 0553 - Identification for Mechanical Piping and Equipment.
- E. Section 22 0719 - Mechanical Piping Insulation.
- F. Section 22 0516 - Expansion Fittings and Loops for Plumbing Piping.
- G. Section 31 2316 - Excavation.

#### 1.3 REFERENCE STANDARDS

- A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2011.
- B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.
- C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.
- D. ASME B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings - DWV; 2011.
- E. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV; 2012.
- F. ASME B31.9 - Building Services Piping; 2014.
- G. ASSE 1003 - Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems; 2009.
- H. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999 (Reapproved 2014).
- I. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- J. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2015.
- K. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2015.
- L. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).
- M. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2015a.

- N. ASTM B43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes; 2014.
  - O. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2014.
  - P. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2013.
  - Q. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2010.
  - R. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2002 (Reapproved 2010).
  - S. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2014.
  - T. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2012.
  - U. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2014.
  - V. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings; 1996 (Reapproved 2010).
  - W. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2015.
  - X. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2012.
  - Y. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2009.
  - Z. AWWA C550 - Protective Interior Coatings for Valves and Hydrants; 2013.
  - AA. AWWA C606 - Grooved and Shouldered Joints; 2011.
  - AB. AWWA C651 - Disinfecting Water Mains; 2005.
  - AC. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; 2009.
  - AD. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2011.
  - AE. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.
  - AF. MSS SP-67 - Butterfly Valves; 2011.
  - AG. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.
  - AH. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).
  - AI. NSF 372 - Drinking Water System Components - Lead Content; 2011.
- 1.4 SUBMITTALS
- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.



## 1.5 QUALITY ASSURANCE

- A. Perform work in accordance with applicable codes and local standards and requirements.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.
- D. All grooved couplings and fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components. All castings used shall be date stamped for quality assurance and traceability.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

## 1.7 FIELD CONDITIONS

- A. Do not install underground piping when bedding is wet or frozen.

# PART 2 PRODUCTS

## 2.1 GENERAL REQUIREMENTS

- A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

## 2.2 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Cast Iron Pipe: ASTM A74 extra heavy weight.
  - 1. Fittings: Cast iron.
  - 2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.
- B. PVC Pipe: ASTM D2665 or ASTM D3034.
  - 1. Fittings: PVC.
  - 2. Joints: Solvent welded, with ASTM D2564 solvent cement.

## 2.3 SANITARY SEWER PIPING, ABOVE GRADE

- A. Cast Iron Pipe: ASTM A74, service weight.
  - 1. Fittings: Cast iron.
  - 2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.
- B. Cast Iron Pipe: CISPI 301, hubless, service weight.
  - 1. Fittings: Cast iron.
  - 2. Joints: CISPI 310, neoprene gaskets and type MG stainless steel clamp-and-shield assemblies.

- C. Copper Tube: ASTM B88 (ASTM B88M), Type K (A).
    - 1. Fittings: ASME B16.29, wrought copper, or ASME B16.23, solvent.
    - 2. Joints: ASTM B32, alloy Sn50 solder.
  - D. Brass Pipe: ASTM B43, chrome plated.
    - 1. Fittings: ASME B16.23, cast bronze, chrome plated.
    - 2. Joints: Mechanical compression.
  - E. PVC Pipe: ASTM D2665.
    - 1. Fittings: PVC.
    - 2. Joints: Solvent welded, with ASTM D2564 solvent cement.
- 2.4 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING
- A. Copper Pipe: ASTM B42, hard drawn, type K.
    - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
    - 2. Joints: ASTM B 32, alloy Sn95 solder.
  - B. Ductile Iron Pipe: AWWA C151/A21.51.
    - 1. Fittings: Ductile or gray iron, standard thickness.
    - 2. Joints: AWWA C111/A21.11, styrene butadiene rubber (SBR) or vulcanized SBR gasket with 3/4 inch diameter rods.
- 2.5 DOMESTIC WATER PIPING, ABOVE GRADE
- A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).
    - 1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
    - 2. Joints: ASTM B32, alloy Sn95 solder. Piping 2" and larger shall be brazed.
    - 3. Joints: Grooved mechanical couplings.
- 2.6 STORM WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING
- A. Cast Iron Pipe: ASTM A74 extra heavy weight.
    - 1. Fittings: Cast iron.
    - 2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.
  - B. PVC Pipe: ASTM D2665 or ASTM D3034.
    - 1. Fittings: PVC.
    - 2. Joints: Solvent welded, with ASTM D2564 solvent cement.
- 2.7 STORM WATER PIPING, ABOVE GRADE
- A. Cast Iron Pipe: CISPI 301, hubless, service weight.
    - 1. Fittings: Cast iron.
    - 2. Joints: Neoprene gaskets and type MG stainless steel clamp-and-shield assemblies.
  - B. PVC Pipe: ASTM D2665 or ASTM D3034.
    - 1. Fittings: PVC.
    - 2. Joints: Solvent welded, with ASTM D2564 solvent cement.
- 2.8 NATURAL GAS PIPING, ABOVE GRADE
- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
    - 1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
    - 2. Joints: Threaded or welded to ASME B31.1.

## 2.9 FLANGES, UNIONS, AND COUPLINGS

- A. Unions for Pipe Sizes 3 Inches and Under:
  - 1. Ferrous pipe: Class 150 malleable iron threaded unions.
  - 2. Copper tube and pipe: Class 150 bronze unions with soldered joints.
- B. Flanges for Pipe Size Over 1 Inch:
  - 1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
  - 2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.
- C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
  - 1. Dimensions and Testing: In accordance with AWWA C606.
  - 2. Housing Material: Provide ASTM A47/A47M malleable iron or ductile iron, galvanized.
  - 3. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
  - 4. When pipe is field grooved, provide coupling manufacturer's grooving tools.
- D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

## 2.10 PIPE HANGERS AND SUPPORTS

- A. Provide hangers and supports that comply with MSS SP-58.
  - 1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
  - 2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
  - 3. Trapeze Hangers: Welded steel channel frames attached to structure.
  - 4. Vertical Pipe Support: Steel riser clamp.
  - 5. Floor Supports: Concrete pier or steel pedestal with floor flange; fixture attachment.
- B. Plumbing Piping - Drain, Waste, and Vent:
  - 1. Conform to ASTM B31.9.
  - 2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
  - 3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
  - 4. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.
  - 5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
  - 6. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
  - 7. Vertical Support: Steel riser clamp.
  - 8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
  - 9. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
- C. Plumbing Piping - Water:
  - 1. Conform to ASTM B31.9.
  - 2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
  - 3. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.

4. Hangers for Hot Pipe Sizes 2 Inches to 4 Inches: Carbon steel, adjustable, clevis.
5. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.
6. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
7. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
8. Vertical Support: Steel riser clamp.
9. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
10. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

#### 2.11 GATE VALVES

- A. Manufacturers:
  1. Apollo Valve.
  2. Watts.

#### 2.12 BALL VALVES

- A. Manufacturers:
  1. Apollo Valve.
  2. Watts.
  3. Victaulice Company.
- B. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, threaded or grooved ends with union.

#### 2.13 BUTTERFLY VALVES

- A. Manufacturers:
  1. Grinnell Products, a Tyco Business; B302: [www.grinnell.com](http://www.grinnell.com).
  2. Victaulic Company.
- B. Construction 2-1/2 Inches and Larger: MSS SP-67, 200 psi CWP, cast or ductile iron body, nickel-plated ductile iron disc, resilient replaceable EPDM seat, wafer ends, extended neck, 10 position lever handle.
- C. Provide gear operators for valves 8 inches and larger, and chain-wheel operators for valves mounted over 8 feet above floor.

#### 2.14 SWING CHECK VALVES

- A. Manufacturers:
  1. Apollo Valve.
  2. Watts.

#### 2.15 WATER PRESSURE REDUCING VALVES

- A. Manufacturers:
  1. Watts Regulator Company.
- B. Up to 2 Inches:
  1. ASSE 1003, bronze body, stainless steel, and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.

- C. Over 2 Inches:
  - 1. ASSE 1003, cast iron body with interior lining complying with AWWA C550, bronze fitted, elastomeric diaphragm and seat disc, flanged.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

#### 3.2 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges or unions.

#### 3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- E. Provide all piping offsets and fittings as required for a quality installation.
- F. Group piping whenever practical at common elevations.
- G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 22 0516.
- H. Provide access where valves and fittings are not exposed.
- I. Establish elevations of buried piping outside the building to ensure not less than 5 ft of cover.
- J. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.
- K. Locate plumbing vent terminations a minimum of 20' away from air intakes.
- L. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- M. Provide support for utility meters in accordance with requirements of utility companies.
- N. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.
- O. Install bell and spigot pipe with bell end upstream.
- P. Install valves with stems upright or horizontal, not inverted.
- Q. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood. Locate vent terminations a minimum of 20' away from air intakes or windows.
- R. Install water piping to ASME B31.9.

- S. Install fuel piping to ASME B31.1.
- T. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.
- U. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.
- V. Sleeve pipes passing through partitions, walls and floors constructed of a minimum of 18 gauge sheet metal. Provide schedule 40 pipe as sleeves with appropriate sealant at fire and/or smoke rated penetrations around pipe sleeve. Extend sleeves through floors a minimum of 2" above the floor. Wall sleeves shall be flush with the wall and chrome plated solid steel escutcheons shall be installed.
- W. Inserts:
  - 1. Provide inserts for placement in concrete formwork.
  - 2. Where concrete slabs form finished ceiling, locate inserts with top of sleeve 1" above slab surface.
- X. Pipe Hangers and Supports:
  - 1. Install in accordance with ASME B31.9.
  - 2. Support horizontal piping as indicated.
  - 3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
  - 4. Place hangers within 12 inches of each horizontal elbow.
  - 5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
  - 6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
  - 7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
  - 8. Provide copper plated hangers and supports for copper piping. Use Hydra-Zorb type clamps when copper piping is supported by uni-strut hangers.
  - 9. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
  - 10. Provide hangers adjacent to motor driven equipment with vibration isolation; refer to Section 22 0548.
  - 11. Support cast iron drainage piping at every joint.
- Y. Hydrostatically test water piping with 125 psi of water pressure for 24 hours.
- Z. Hydrostatically test sanitary and storm drainage piping with 10 feet of water column for 30 minutes.
- AA. Test all gas piping with 125 psi of air pressure for 24 hours. Test joints with a soapy water solution.
- AB. Testing of plumbing piping systems shall be witnessed by the Engineer. Provide a minimum of 48 hours of notice prior to the testing.
- AC. Install copper sanitary piping from sink and indirect fixture drains in commercial kitchen and cast iron piping in the kitchen and boiler rooms where high temperature water will be drained into the system.
- AD. Provide chrome plated brass P-traps under lavatories and sinks. Provide chrome escutcheons at wall penetration of waste piping.

- AE. Provide chrome plated water supply pipes where exposed. Provide chrome escutcheons at wall penetration behind water supply stop valve.
- AF. Provide an isolation valve on each branch water pipe within 3' of the main.
- AG. Install a hanger within 12" of each roof drain vertical riser. Provide extra heavy duty couplings on roof drain connections (Fernco or 6-banded no-hub couplings).

### 3.4 APPLICATION

- A. Use grooved mechanical couplings and fasteners only in accessible locations. Grooved joints shall be installed in accordance with the manufacturer's latest published installation instructions. All installations shall be done by factory-trained field personnel. Contractor shall remove and replace any improperly installed products.
- B. Install unions downstream of valves and at equipment or apparatus connections.
- C. Install ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers. Install isolation valves on all branch piping within 3 feet of mains.
- D. Provide spring loaded check valves on discharge of water pumps.
- E. Provide extended valve stems on valves where piping is being insulated to provide required clearance from insulation to operate valve.

### 3.5 TOLERANCES

- A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/8 inch per foot slope.
- B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

### 3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Prior to starting work, verify system is complete, flushed and clean.
- B. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- C. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.
- D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.
- E. Maintain disinfectant in system for 24 hours.
- F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

### 3.7 SERVICE CONNECTIONS

- A. Provide new sanitary sewer services. Before commencing work check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.
- B. Provide new water service complete with approved reduced pressure backflow preventer and water meter with by-pass valves.

1. Provide sleeve in wall for service main and support at wall with reinforced concrete bridge. Calk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.
2. Provide 18 gage, 0.0478 inch galvanized sheet metal sleeve around service main to 6 inch above floor and 6 feet minimum below grade. Size for minimum of 2 inches of loose batt insulation stuffing.

### 3.8 SCHEDULES

#### A. Pipe Hanger Spacing:

1. Metal Piping:
  - a. Pipe Size: 1/2 inches to 1-1/4 inches:
    - 1) Maximum Hanger Spacing: 6.5 ft.
    - 2) Hanger Rod Diameter: 3/8 inches.
  - b. Pipe Size: 1-1/2 inches to 2 inches:
    - 1) Maximum Hanger Spacing: 10 ft.
    - 2) Hanger Rod Diameter: 3/8 inch.
  - c. Pipe Size: 2-1/2 inches to 3 inches:
    - 1) Maximum Hanger Spacing: 10 ft.
    - 2) Hanger Rod Diameter: 1/2 inch.
  - d. Pipe Size: 4 inches to 6 inches:
    - 1) Maximum Hanger Spacing: 10 ft.
    - 2) Hanger Rod Diameter: 5/8 inch.
  - e. Pipe Size: 8 inches to 12 inches:
    - 1) Maximum hanger spacing: 14 ft.
    - 2) Hanger Rod Diameter: 7/8 inch.
  - f. Pipe Size: 14 inches and Over:
    - 1) Maximum Hanger Spacing: 20 ft.
    - 2) Hanger Rod Diameter: 1 inch.
2. Plastic Piping:
  - a. All Sizes:
    - 1) Maximum Hanger Spacing: 6 ft.
    - 2) Hanger Rod Diameter: 3/8 inch.

END OF SECTION 22 1005



## SECTION 22 1006 - PLUMBING PIPING SPECIALTIES

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Drains.
- B. Cleanouts.
- C. Backflow preventers.
- D. Double check valve assemblies.

#### 1.2 RELATED REQUIREMENTS

- A. Section 22 1005 - Plumbing Piping.
- B. Section 22 4000 - Plumbing Fixtures.

#### 1.3 REFERENCE STANDARDS

- A. ASSE 1012 - Backflow Preventer with Intermediate Atmospheric Vent; 2009.
- B. ASSE 1013 - Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers; 2011.
- C. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).
- D. NSF 372 - Drinking Water System Components - Lead Content; 2011.

#### 1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.
- D. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers.
- E. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Accept specialties on site in original factory packaging. Inspect for damage.

### PART 2 PRODUCTS

#### 2.1 GENERAL REQUIREMENTS

- A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

## 2.2 DRAINS

### A. Manufacturers:

1. Jay R. Smith Manufacturing Company: [www.jayrsmith.com](http://www.jayrsmith.com).
2. Zurn Industries, LLC: [www.zurn.com](http://www.zurn.com).
3. Wade.
4. Mifab.

## 2.3 CLEANOUTS

### A. Manufacturers:

1. Jay R. Smith Manufacturing Company: [www.jayrsmith.com](http://www.jayrsmith.com).
2. Zurn Industries, LLC: [www.zurn.com](http://www.zurn.com).
3. Wade.
4. Mifab.

## 2.4 BACKFLOW PREVENTERS

### A. Manufacturers:

1. Watts Regulator Company, a part of Watts Water Technologies: [www.wattsregulator.com](http://www.wattsregulator.com).
2. Zurn Industries, LLC: [www.zurn.com](http://www.zurn.com).

### B. Reduced Pressure Backflow Preventers:

1. ASSE 1013; bronze body with bronze internal parts and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

## 2.5 DOUBLE CHECK VALVE ASSEMBLIES

### A. Manufacturers:

1. Watts Regulator Company, a part of Watts Water Technologies: [www.wattsregulator.com](http://www.wattsregulator.com).
2. Zurn Industries, LLC: [www.zurn.com](http://www.zurn.com).

### B. Double Check Valve Assemblies:

1. ASSE 1012; Bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.
- C. Encase exterior cleanouts in concrete flush with grade.
- D. Install floor cleanouts at elevation to accommodate finished floor.
- E. Install all floor drains, floor sinks and roof drains with flashing clamps and flashings as recommended by manufacturer. Floor drains shall be provided with a Chloraloy flashing.

- F. Install approved portable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.
- G. Pipe relief from backflow preventer to nearest drain.
- H. Install air chambers on hot and cold water supply piping to each fixture or group of fixtures (each washroom). Fabricate same size as supply pipe or 3/4 inch minimum, and minimum 18 inches long.
- I. Install wall cleanouts at a minimum of 12" above the highest flood rim of any associated fixture.

END OF SECTION 22 1006

## SECTION 22 3000 - PLUMBING EQUIPMENT

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Water Heaters:
  - 1. Commercial electric.
- B. Diaphragm-type compression tanks.
- C. Submersible sump pumps.

#### 1.2 RELATED REQUIREMENTS

- A. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

#### 1.3 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittals procedures.
- B. Product Data:
  - 1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
  - 2. Indicate pump type, capacity, power requirements.
  - 3. Provide electrical characteristics and connection requirements.
- C. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.
- D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

#### 1.5 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer warranty for domestic water heaters.

### PART 2 PRODUCTS

#### 2.1 WATER HEATERS

- A. Manufacturers:
  - 1. A.O. Smith Water Products Co: [www.hotwater.com](http://www.hotwater.com).
  - 2. Eemax
- B. Commercial Electric:
  - 1. Type: Factory-assembled and wired, electric, vertical storage.
  - 2. Performance:
  - 3. Electrical Characteristics:
  - 4. Controls: Automatic immersion water thermostat; externally adjustable temperature range from 60 to 180 degrees F, flanged or screw-in nichrome elements, high temperature limit thermostat.

5. Heating Elements: Flange-mounted immersion elements; individual elements sheathed with Incoloy corrosion-resistant metal alloy, rated less than 75 W/sq in.

## 2.2 DIAPHRAGM-TYPE COMPRESSION TANKS

- A. Manufacturers:
  1. Amtrol Inc: [www.amtrol.com](http://www.amtrol.com).
  2. Bell & Gossett, a xylem brand: [www.bellgossett.com](http://www.bellgossett.com).
  3. Taco, Inc: [www.taco-hvac.com](http://www.taco-hvac.com).
- B. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible EPDM diaphragm sealed into tank, and steel legs or saddles.
- C. Accessories: Pressure gage and air-charging fitting, tank drain; precharge to 12 psig.

## 2.3 SUBMERSIBLE SUMP PUMPS

- A. Manufacturers:
  1. Zoeller Company: [www.zoeller.com](http://www.zoeller.com).
  2. Stancor.
- B. Type: Completely submersible, vertical, centrifugal.
- C. Casing: Cast iron pump body and oil filled motor chamber.
- D. Impeller: Cast iron; open non-clog, stainless steel shaft.
- E. Bearings: Ball bearings.
- F. Sump: Fiberglass basin with steel cover plate with drain holes/slots; 18 inches diameter, 30 inches deep.
- G. Accessories: Oil resistant 6 foot cord and plug with three-prong connector for connection to electric wiring system including grounding connector.
- H. Servicing: Slide-away coupling consisting of discharge elbow secure to sump floor, movable bracket, guide pipe system, lifting chain and chain hooks.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.
- B. Coordinate with plumbing piping and related fuel piping work to achieve operating system.
- C. Pumps:
  1. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

END OF SECTION 22 3000

## SECTION 22 4000 - PLUMBING FIXTURES

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Water closets.
- B. Urinals.
- C. Lavatories.
- D. Sinks.
- E. Service sinks.
- F. Wall hydrants.

#### 1.2 RELATED REQUIREMENTS

- A. Section 07 9005 - Joint Sealers: Seal fixtures to walls and floors.
- B. Section 22 1005 - Plumbing Piping.

#### 1.3 REFERENCE STANDARDS

- A. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment; 2009.
- B. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).
- C. NSF 372 - Drinking Water System Components - Lead Content; 2011.

#### 1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.
- C. Maintenance Data: Include fixture trim exploded view and replacement parts lists.
- D. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Accept fixtures on site in factory packaging. Inspect for damage.
- B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

#### 1.6 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five (5) year manufacturer warranty for electric water cooler.

## PART 2 PRODUCTS

### 2.1 GENERAL

- A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

### 2.2 (SEE DRAWING FOR PLUMBING FIXTURE SCHEDULE)

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.
- B. Verify that electric power is available and of the correct characteristics.
- C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

### 3.2 PREPARATION

- A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

### 3.3 INSTALLATION

- A. Install each fixture with trap, easily removable for servicing and cleaning.
- B. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.
- C. Install components level and plumb.
- D. Install and secure fixtures in place with wall supports and bolts.
- E. Seal fixtures to wall and floor surfaces with sealant as specified in Section 07 9005, color to match fixture.
- F. Install a screw anchor under lavatory, on each side, to secure to wall.

### 3.4 INTERFACE WITH WORK OF OTHER SECTIONS

- A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

### 3.5 ADJUSTING

- A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

### 3.6 CLEANING

- A. Clean plumbing fixtures and equipment.

### 3.7 PROTECTION

- A. Protect installed products from damage due to subsequent construction operations.
- B. Repair or replace damaged products before Date of Substantial Completion.

### 3.8 SCHEDULES

- A. Fixture Heights: Install fixtures to heights above finished floor as indicated on Architectural Drawings. If no heights are given there, mount as indicated below.
1. Water Closet:
    - a. Standard: 15 inches to top of bowl rim.
    - b. Accessible: 18 inches to top of seat.
  2. Urinal:
    - a. Standard: 22 inches to top of bowl rim.
    - b. Accessible: 17 inches to top of bowl rim.
  3. Lavatory:
    - a. Standard: 31 inches to top of basin rim.
    - b. Accessible: 34 inches to top of basin rim.
  4. Drinking Fountain:
    - a. Standard Adult: 40 inches to top of basin rim.
    - b. Accessible: 36 inches to top of spout.
  5. Emergency Eye and Face Wash:
    - a. Standard: 38 inches to receptor rim.
  6. Emergency Shower:
    - a. Standard: 84 inches to bottom of head.

END OF SECTION 22 4000



## SECTION 23 0050 - GENERAL MECHANICAL PROVISIONS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. The work required under Heating, Ventilating, and Air Conditioning Contract shall include all material, labor, equipment and services necessary and reasonably incidental to the proper completion of the systems, and all special work as hereinafter specified and indicated on the drawings.
- B. All work shall be executed in such a manner as to interfere as little as possible with the normal functioning of the facility, including operations of all utility services and any equipment, and with work being done by others. Roads shall be kept clear of materials, etc., at all times so that there will be no interference with the usual traffic. Where necessary, on account of new work connecting to existing pipes, where utility services are required to be cut, they shall be cut and capped at suitable places where indicated by drawings, or in the absence of such indication, where directed by the Architect/Engineer. No road traffic or utility service such as water, gas, or sewer shall be interrupted without prior approval of the Owner, and all arrangements for work which will involve such interference shall be made in advance with the Owner so that same can be effected in a minimum of time and interference.

#### 1.2 RELATED SECTIONS

- A. Section 01 0000 - General Requirements
- B. Section 00 7200 - General Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.
- C. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- D. Section 01 7000 - Execution and Closeout Requirements: Contract closeout procedures.
- E. Individual Product Sections: Specific requirements for operation and maintenance data.
- F. Individual Product Sections: Warranties required for specific products or Work.

#### 1.3 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS

- A. Drawings and specifications shall be taken together. Provide work specified and not indicated, or work indicated and not specified as though mentioned in both.
- B. In case of discrepancy between drawings and specifications, or within either document, the greater quantity of work and/or better quality shall be used for estimating and the matter brought to the Architect/Engineer's attention for a written decision.
- C. Drawings are to be interpreted as diagrammatic only, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment. It should be understood that the Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pipes and ducts so as to best fit the layout of the job. Scaling of the drawings will not be sufficient or accurate for determining these locations. Contractor shall refer to the Architectural drawing for dimensions of walls, foundations, structural beams, and other structural building members. Where job conditions require reasonable

changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.

- D. Because of the scale of the drawings, certain basic items, such as fittings, boxes, valves, unions, etc., may not be shown, but where such items are required by other sections of the specifications or where they are required for proper installation of the work, such items shall be furnished and installed.
- E. The determination of quantities of material and equipment required shall be made by the Contractor from the drawings. Schedules on the drawings and in the specifications are completed as an aid to the Contractor but where discrepancies arise, the greater number shall govern.
- F. Where words "provide", "install", or "furnished" are used on the drawings or in the specifications, it shall be taken to mean, to furnish, install and connect up complete and ready for operation, the items mentioned.

#### 1.4 COOPERATION AND PROGRESS

- A. Keep informed about the work of all other trades engaged in the project and execute the work in such a manner as not to delay or interfere with the progress of other contractors. This contractor shall schedule his work so that no other contractor is delayed in the execution of his work. Complete cooperation of all trades is expected. Employ a competent foreman on job throughout the entire project to ensure that coordination is maintained.
- B. Schedule and coordinate the work of this Division with the schedule of the contractor to progress the work expeditiously, and to avoid unnecessary delays.
- C. Examine fully the drawings and specifications for other contractors for other trades, and coordinate the installation of this work with the work of the other contractors. Consult and cooperate with other contractors for determining space requirements and for determining that adequate clearance is allowed with respect to his equipment, other equipment, and the building. The Owner's representative reserves the right to determine space priority in the event of interference between piping, conduit, ducts, and equipment of the various contractors.
- D. Conflicts between the drawings and the specification shall be called to the attention of the Owner's representative and Architect/Engineer. If clarification is not asked for prior to the taking of bids, it will be assumed that none is required and that the contractor is in agreement with the drawings and specifications as issued. If clarification is required after the Contract is awarded, such clarification will be made by the Architect/Engineer and his decision will be final.
- E. Coordinate the installation of all mechanical system components with all other trades, including structural components and electrical trades. Allocate space in the different areas to allow for the installation of ductwork, piping, sprinklers, waste and vents, and mechanical equipment above ceilings and in equipment spaces. Recommend rerouting, resizing or relocation of mechanical components, if necessary, so all trades can install their systems in the space allotted. Any proposed changes from the systems layout, on the drawings, shall be done in accordance with the design criteria specified in the applicable codes and shall be subject to the review and acceptance of the Architect/Engineer.
- F. After award of the Contract, and prior to start of construction, the General Contractor shall schedule a meeting with the contractor and all subcontractors responsible of the

work items listed above. The purpose of the meeting is to introduce the coordination program and to determine its implementation in relation to the progress schedule.

- G. All contractors and subcontractors shall participate in the coordination process. Participation is mandatory. If a contractor or subcontractor fails to participate in the coordination process, the Owner reserves the right to do the following:
  - 1. Stop any and all construction progress payments for any work performed by the contractor. Such payments will be reinstated only after the contractor or subcontractor resumes participation in the coordination drawing process.
  - 2. Relocate and resize contractor's work components as necessary to ensure all components will be installed as intended. In the event the contractor did not participate in the coordination process, he will not be entitled to any contract cost increases or time extensions due to Owner initiated changes in the work.
- H. The contractor shall also be held responsible for any unnecessary rework by other trade contractors that is attributable to his failure to participate in the coordination process.
- I. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility because of the scale of the drawings. Each contractor is expected to have included in his bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process. The contractor will not be allowed any contract cost extra or time extension for changes dictated by the coordination process.
- J. Utility installation in congested areas is dependent on the sequence of utility installation as much as it is dependent on the physical size of the utilities. The contractors shall use the coordination process to properly sequence the installation of utilities as appropriate to ensure the above ceiling and congested area utility installation is satisfactory.

#### 1.5 GUARANTEE

- A. The Contractor, by the acceptance of this specification and the signing of the Contract, acknowledges his acquaintance with all the requirements and guarantees that every part going to make up the system, will be the best of its respective kind and will be erected in a most thorough and substantial manner by none but experienced labor.
- B. The Contractor guarantees that all piping as provided in this specification will be free from all obstructions, and that all piping will be tight and drip free.
- C. The Contractor guarantees that, in the entire hydronic piping system, a continuous and noiseless circulation of water will be established to all fixtures; and that water may be drawn from any fixture without hammering.
- D. The Contractor guarantees that the entire system of ductwork will provide free circulation of air without objectionable noise and that all air distribution within the conditioned space will be draftless and reasonably quiet.
- E. The Contractor guarantees that all equipment and appliances will successfully and acceptably perform the work for which they are installed and that each will operate smoothly and quietly up to its rated capacity.
- F. The Contractor further guarantees himself responsible for any defects which may develop in any part of the system, including equipment, piping, fixtures and appliances, due to faulty workmanship, design or material; and to replace and make good, without cost to the Owner, any such faulty parts or construction which develop defects at any time within one (1) year from the date of substantial completion. The date of substantial completion shall be as defined in the Contract Documents. Any repairs or replacement

required on account of defects, as outlined in this paragraph shall be made promptly upon written notice from the Architect.

- G. Natural wear, accident, or carelessness on the part of others, however, shall not be made good by the Contractor.

#### 1.6 PROTECTION OF INSTALLED WORK AND MATERIAL STORED ON SITE

- A. The Contractor is responsible for all work installed by him until his contract is complete and shall protect it from injury by others.
- B. All piping, fittings, equipment and material to be stored on the jobsite for any period of time shall be protected from the weather in a manner that is acceptable to the Architect.

#### 1.7 SITE VISIT

- A. Bidders are advised to visit the site and inform themselves as to all conditions, and failure to do so will in no way relieve the successful bidder from the necessity of furnishing any material or performing any work that may be required to complete the work in accordance with the true intent and meaning of the drawings and specifications without additional cost to the Owner.
- B. Before bidding the job, investigate, determine and verify locations and invert elevations of sanitary and storm sewers, city water mains and any other buried or overhead utilities on or near site. Determine such locations in conjunction with all public and private utility companies and with all authorities having jurisdiction.
- C. On projects where remodeling of an existing structure is in the scope of the project, the contractor shall field verify locations of existing piping and ductwork. The contractor shall verify the exact locations of existing piping and ductwork to which the new ductwork and new piping are to connect and if the locations of the existing piping and ductwork are different than that shown on the drawings, the contractor shall include the additional cost in his bid proposal. The contractor shall also field verify the locations of existing piping and ductwork that are in conflict with the routing of the new work, and include in his bid proposal monies for the rerouting of the existing work in order to accommodate the new work.

#### 1.8 RULES, REGULATIONS AND CODES

- A. The Contractor shall become acquainted with the local codes, and in case of a discrepancy between plans or specifications and the local codes, the Contractor shall use the code requirements. The greater quantity of work and material and/or better quality shall be used for estimating and the matter brought to the Architect's attention for a written decision.
- B. Perform all work in strict accordance with all rules, regulations, codes, ordinances, or laws of Local, State, and Federal governments, or of other authorities having lawful jurisdiction. Comply therewith. Such rules, regulations, codes, ordinances, or laws include, but are not necessarily limited to, the following:
  - 1. State building and fire codes.
  - 2. State plumbing and mechanical codes.
  - 3. City building and fire codes.
  - 4. City plumbing and mechanical codes.
  - 5. American Gas Association.
  - 6. National Electric Code.
  - 7. National Fire Protection Association.

8. Occupation Safety and Health Act.

- C. If the Contractor notes, at the time of bidding, any parts of the plans and specifications which are not in accord with the applicable codes or regulations, he shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time to follow this procedure, he shall submit with his proposal a separate price required to make the system shown on the drawings comply with the codes and regulations.
- D. All changes to the system made after the letting of the contract, in order to comply with the applicable codes or the requirements of the inspector, shall be made by the Contractor without cost to the Owner.

1.9 SUBSTITUTIONS

- A. The Architect/Engineer shall be the sole and final judge as to the suitability of items substituted for those specified.
- B. The entire cost of all changes of any type due to substitutions for materials specified shall be borne by the Contractor at no extra cost to the Owner.
- C. Unsolicited and voluntary deducts, on the part of the Contractor for substituting unapproved equipment, shall not be considered for the purpose of awarding the Contract.
- D. When the drawings and/or specifications refer to any item, article, material, method, fabrication, assembly or construction by means of one or more manufacturer's trade name, catalog reference or similar means of identification of manufacturer, the Contractor shall furnish one of the makes so identified without substitution unless other make or makes have been approved by addendum to the contract documents prior to the receipt of bids. Requests for the approval of items of equal quality are requested to be made in writing to the Architect/Engineer five days prior to the date of the receipt of bids so that a list of acceptable equal quality items can be made known to all bidders by an addendum. If substitution for names items, articles, materials, methods, fabrications, assembly or construction are approved, the Contractor assumes all responsibility for coordination and performing the related changes in the work necessitated by such substitutions and shall include in his bid all costs involved therein.

1.10 SHOP DRAWING REVIEW

- A. Shop drawings will be reviewed only to extent of information indicated. This check is only for review of general conformance with the design concept of the project and general compliance with the information given the contract documents. The contractor is responsible for confirming and correlating all quantities and dimensions, selecting fabrication processes techniques of construction, coordinating his work in a safe and satisfactory manner.
- B. Review of shop drawings shall not relieve Contractor of responsibility for providing all controls, wiring, components, etc., which are shown or specified, or all additional controls, wiring, components, etc., required to provide complete and correctly operating mechanical systems.
- C. In cases where substituted equipment has been installed in place of specified equipment the Contractor shall bear the entire cost of all changes of any type due to the substitution, even though the shop drawings have been reviewed by the Architect/Engineer.

- D. Shop drawings in no way relieve the contractor from performing on the job as to the intent of the construction documents.

#### 1.11 CONNECTING NEW WORK TO EXISTING WORK

- A. Connect new work to existing work in a neat workmanlike manner. In every case where any part of the existing work must be cut to install new work, or is damaged, same must be patched and repaired in a manner satisfactory to the Architect. Where relocation of existing equipment and piping systems is necessary in areas providing uninterruptible services, schedule work during slack periods. Anticipate scheduling work at a period which will result in additional construction cost, such as overtime for work to be done at night or on weekends. Include cost in the bid proposal.
- B. Do not cut into existing services without first informing the Owners representative as to the time and duration of shutdown of the existing services.
- C. Perform work that interrupts any service at a time that will cause least interference to the operation of the building.
- D. Maintain all existing services and equipment unless indicated to be removed.

#### 1.12 ACCESS TO EQUIPMENT FOR MAINTENANCE

- A. Install all equipment, piping, etc., to permit access for normal maintenance. Maintain easy access to filters, motors, drive compressors, coils, etc. Install all such equipment and accessories to facilitate maintenance. Perform any relocation of pipes, ducts, etc. required to permit access at request of Architect/Engineer at no additional cost to Owner.

#### 1.13 FIRE AND SMOKE STOPPAGE

- A. It shall be the responsibility of this Contractor to maintained and fire and smoke integrity of all walls, ceilings, floors, etc., through which this work passes through or into. Fire and smoke barriers shall be provided in and around as required by Codes.
- B. Where holes are required to be patched, or conduit, piping, ducts, etc., are required to be patched around, it shall be filled with a material that is UL Classified Standard 1479 for this use and Factory Mutual System approved.
- C. Fire and smoke stoppage material shall be water based with intumescent properties. Material may be in the form of caulking, putty pads or wrap strips. Materials shall be installed in accordance to manufacturers and UL standards.

#### 1.14 TEMPORARY HEAT/COOLING

- A. Where temporary heating/cooling is needed after the building is enclosed, this may be provided through the use of the project's permanent heating/cooling equipment, but only after permission is obtained from the Owner/Architect.
- B. The cost of fuel/energy for the temporary heating/cooling shall be included in the project. The Mechanical Contractor shall coordinate these costs with the General Contractor as required.
- C. The Mechanical Contractor assumes responsibility for the operation and maintenance of the equipment during the temporary heating/cooling period. This operation shall not alter or void the specified warranty period from the time of acceptance of the entire project by the Owner.

- D. Temporary filters shall be placed in all equipment and in all return air openings and they shall be kept clean during operation. New filters shall be installed, unused, at the time of project completion.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION- NOT USED

END OF SECTION 23 0050

## SECTION 23 0501 - CLOSEOUT SUBMITTALS FOR HVAC

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Project Record Documents.
- B. Operation and Maintenance Data.
- C. Warranties and bonds.

#### 1.2 RELATED SECTIONS

- A. Section 00 7200 - General Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.
- B. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- C. Individual Product Sections: Specific requirements for operation and maintenance data.
- D. Individual Product Sections: Warranties required for specific products or Work.

#### 1.3 SUBMITTALS

- A. Project Record Documents: Submit documents to Engineer .
- B. Operation and Maintenance Data:
  - 1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Engineer will review draft and return one copy with comments.
  - 2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
  - 3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Engineer comments. Revise content of all document sets as required prior to final submission.
  - 4. Submit two sets of revised final documents in final form within 10 days after final inspection.
- C. Warranties and Bonds:
  - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
  - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
  - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.



## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

### 3.1 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
  - 1. Drawings.
  - 2. Addenda.
  - 3. Change Orders and other modifications to the Contract.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Record Drawings : Legibly mark each item to record actual construction including:
  - 1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
  - 2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
  - 3. Field changes of dimension and detail.

### 3.2 OPERATION AND MAINTENANCE DATA

- A. For Each Product or System: List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

### 3.3 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
  - 1. Description of unit or system, and component parts.
  - 2. Identify function, normal operating characteristics, and limiting conditions.
  - 3. Include performance curves, with engineering data and tests.
  - 4. Complete nomenclature and model number of replaceable parts.
- B. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- C. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- D. Provide servicing and lubrication schedule, and list of lubricants required.
- E. Include manufacturer's printed operation and maintenance instructions.

- F. Include sequence of operation by controls manufacturer.
- G. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- H. Provide control diagrams by controls manufacturer as installed.
- I. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
- J. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- K. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- L. Include test and balancing reports.
- M. Additional Requirements: As specified in individual product specification sections.

### 3.4 OPERATION AND MAINTENANCE MANUALS

- A. Prepare instructions and data by personnel experienced in maintenance and operation of described products.
- B. Prepare data in the form of an instructional manual.
- C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- E. Provide tabbed dividers for each separate product and system, with typed description of product and major component parts of equipment.
- F. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
  - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Engineer, Contractor, Subcontractors, and major equipment suppliers.
  - 2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
    - a. Significant design criteria.
    - b. List of equipment.
    - c. Parts list for each component.
    - d. Operating instructions.
    - e. Maintenance instructions for equipment and systems.
  - 3. Part 3: Project documents and certificates, including the following:
    - a. Shop drawings and product data.
    - b. Air and water balance reports.
    - c. Photocopies of warranties and bonds.

### 3.5 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of

work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.

- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Include originals of each in operation and maintenance manuals, indexed separately on Table of Contents.

END OF SECTION 23 0501

## SECTION 23 0502 - DEMONSTRATION AND TRAINING FOR HVAC SYSTEMS

### PART 1 GENERAL

#### 1.1 SUMMARY

- A. Demonstration of products and systems where indicated in specific specification sections.
- B. Training of Owner personnel in operation and maintenance is required for:
  - 1. HVAC systems and equipment.

#### 1.2 RELATED SECTIONS

- A. Section 22 0501 - Closeout Submittals: Operation and maintenance manuals.
- B. Other Specification Sections: Additional requirements for demonstration and training.

#### 1.3 SUBMITTALS

- A. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
  - 1. Include applicable portion of O&M manuals.
  - 2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
  - 3. Provide one extra copy of each training manual to be included with operation and maintenance data.
- B. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.
  - 1. Format: DVD Disc.
  - 2. Label each disc and container with session identification and date.
- C. System Diagrams: Require system diagrams to be mounted in each mechanical equipment room with stainless steel frame and clear acrylic front, with all operating piping, valves, controls, and air and water flows shown. Final balance flows, pressures, temperatures, motor horsepower, pump and fan curves, and belt sizes shall be shown.

#### 1.4 QUALITY ASSURANCE

- A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
  - 1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
  - 2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

### PART 2 PRODUCTS - NOT USED

### PART 3 EXECUTION

#### 3.1 DEMONSTRATION - GENERAL

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.
- B. Demonstration may be combined with Owner personnel training if applicable.

- C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
  - 1. Perform demonstrations not less than two weeks prior to Substantial Completion.
  - 2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
  - 1. Perform demonstrations not less than two weeks prior to Substantial Completion.

### 3.2 TRAINING - GENERAL

- A. Conduct training on-site unless otherwise indicated.
- B. Provide training in minimum two hour segments.
- C. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
  - 1. The location of the O&M manuals and procedures for use and preservation; backup copies.
  - 2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
  - 3. Typical uses of the O&M manuals.
- D. Product- and System-Specific Training:
  - 1. Review the applicable O&M manuals.
  - 2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
  - 3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
  - 4. Provide hands-on training on all operational modes possible and preventive maintenance.
  - 5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
  - 6. Discuss common troubleshooting problems and solutions.
  - 7. Discuss any peculiarities of equipment installation or operation.
  - 8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
  - 9. Review recommended tools and spare parts inventory suggestions of manufacturers.
  - 10. Review spare parts and tools required to be furnished by Contractor.
  - 11. Review spare parts suppliers and sources and procurement procedures.
- E. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three (3) days.

END OF SECTION 23 0502

## SECTION 23 0513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. General construction and requirements.
- B. Applications.
- C. Single phase electric motors.
- D. Three phase electric motors.

#### 1.2 RELATED REQUIREMENTS

- A. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

#### 1.3 REFERENCE STANDARDS

- A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015.
- B. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; 2004.
- C. NEMA MG 1 - Motors and Generators; 2014.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

#### 1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.
- C. Operation Data: Include instructions for safe operating procedures.
- D. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

#### 1.5 QUALITY ASSURANCE

- A. Conform to NFPA 70.

### PART 2 PRODUCTS

#### 2.1 GENERAL CONSTRUCTION AND REQUIREMENTS

- A. Electrical Service: Refer to Section 26 0583 for required electrical characteristics.
- B. Nominal Efficiency:
  - 1. NEMA Premium motors with efficiencies outlined in MG 1 Table 12.
- C. Construction:
  - 1. Open drip-proof type except where specifically noted otherwise.
  - 2. Design for continuous operation in 104 degrees F environment.
  - 3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.

- D. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.
- E. Wiring Terminations:
  - 1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
  - 2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

## 2.2 APPLICATIONS

- A. Exception: Motors less than 250 watts, for intermittent service may be the equipment manufacturer's standard and need not conform to these specifications.
- B. Single phase motors for fans, blowers, and pumps: Capacitor start, capacitor run type.
- C. Motors located in exterior locations and direct drive axial fans: Totally enclosed type.

## 2.3 SINGLE PHASE POWER - CAPACITOR START MOTORS

- A. Starting Torque: Three times full load torque.
- B. Starting Current: Less than five times full load current.

## 2.4 THREE PHASE POWER - SQUIRREL CAGE MOTORS

- A. Starting Torque: Between 1 and 1-1/2 times full load torque.
- B. Starting Current: Six times full load current.
- C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.
- D. Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B motors.
- E. Insulation System: NEMA Class B or better.
- F. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
- G. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
- H. Sound Power Levels: To NEMA MG 1.
- I. Nominal Efficiency: As indicated at full load and rated voltage when tested in accordance with IEEE 112.
- J. Nominal Power Factor: As scheduled at full load and rated voltage when tested in accordance with IEEE 112.
- K. Shaft Grounding: Provide brush type shaft grounding kits on all motors 5 horsepower size or larger as manufactured by Helwig.

END OF SECTION 23 0513

## SECTION 23 0514 - VARIABLE FREQUENCY CONTROLLERS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Variable frequency controllers.

#### 1.2 RELATED SECTIONS

- A. Section 26 0553 - Identification for Electrical Systems: Engraved nameplates.
- B. Section 26 2813 - Fuses.

#### 1.3 REFERENCES

- A. NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable Speed Drive Systems; National Electrical Manufacturers Association; 2000.

#### 1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.
- C. Shop Drawings: Indicate front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends. Shop drawings shall indicate the Short Circuit Current Rating (SCCR).
- D. Operation Data: NEMA ICS 7.1. Include instructions for starting and operating controllers, and describe operating limits that may result in hazardous or unsafe conditions.
- E. Maintenance Data: NEMA ICS 7.1. Include routine preventive maintenance schedule.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to components, enclosure, and finish.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Allen Bradley/Rockwell Automation.
- B. Asea Brown Boveri (ABB).
- C. Danfoss Graham.
- D. Yaskawa.
- E. Square D.



## 2.2 DESCRIPTION

- A. Variable Frequency Controllers: Enclosed controllers suitable for operating the indicated loads, in conformance with requirements of NEMA ICS 7. Select unspecified features and options in accordance with NEMA ICS 3.1.
  - 1. Employ microprocessor-based inverter logic isolated from power circuits.
  - 2. Employ pulse-width-modulated inverter system.
  - 3. Design for ability to operate controller with motor disconnected from output.
  - 4. Design to attempt five automatic restarts following fault condition before locking out and requiring manual restart.
- B. Enclosures: NEMA 250, Type 1, suitable for equipment application in places restricted to persons employed on the premises.
- C. The Variable Frequency Controller shall have a minimum SCCR of 65,000-Amperes.
- D. The variable frequency controller shall have integral phase loss/imbalance and under voltage protection on all 3-phase products.

## 2.3 OPERATING REQUIREMENTS

- A. Rated Input Voltage: 208 volts, three phase, 60 Hertz.
- B. Motor Nameplate Voltage: 200 volts, three phase, 60 Hertz.
- C. Displacement Power Factor: Between 1.0 and 0.95, lagging, over entire range of operating speed and load.
- D. Operating Ambient: 0 degrees C to 40 degrees C.
- E. Volts Per Hertz Adjustment: Plus or minus 10 percent.
- F. Current Limit Adjustment: 60 to 110 percent of rated.
- G. Acceleration Rate Adjustment: 0.5 to 30 seconds.
- H. Deceleration Rate Adjustment: 1 to 30 seconds.
- I. Input Signal: 4 to 20 mA DC.

## 2.4 COMPONENTS

- A. Display: Provide integral digital display to indicate output voltage, output frequency, and output current.
- B. Status Indicators: Separate indicators for overcurrent, overvoltage, ground fault, overtemperature, and input power ON.
- C. Furnish HAND-OFF-AUTOMATIC selector switch and manual speed control.
- D. Control Power Source: Separate circuit.
- E. Door Interlocks: Furnish mechanical means to prevent opening of equipment with power connected, or to disconnect power if door is opened; include means for defeating interlock by qualified persons.
- F. Safety Interlocks: Furnish terminals for remote contact to inhibit starting under both manual and automatic mode.
- G. Control Interlocks: Furnish terminals for remote contact to allow starting in automatic mode.

- H. Emergency Stop: Use dynamic brakes for emergency stop function.
- I. Disconnecting Means: Include integral fused disconnect switch on the line side of each controller. Disconnect shall have a minimum AIC of 65k amperes.
- J. Wiring Terminations: Match conductor materials and sizes indicated.

## 2.5 SOURCE QUALITY CONTROL

- A. Shop inspect and perform standard productions tests for each controller.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with NEMA ICS 7.1 and manufacturer's instructions.
- B. Tighten accessible connections and mechanical fasteners after placing controller.
- C. Provide fuses in fusible switches; refer to Section 26 2813 for product requirements.
- D. Provide engraved plastic nameplates; refer to Section 26 0553 for product requirements and location.

### 3.2 MANUFACTURER'S FIELD SERVICES

- A. Provide the service of the manufacturer's field representative to prepare and start controllers.

### 3.3 ADJUSTING

- A. Make final adjustments to installed controller to assure proper operation of load system. Obtain performance requirements from installer of driven loads.

### 3.4 DEMONSTRATION

- A. Demonstrate operation of controllers in automatic and manual modes.

END OF SECTION 23 0514

## SECTION 23 0548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Equipment support bases.
- B. Vibration isolators.
- C. Roof curbs.

#### 1.2 REFERENCE STANDARDS

- A. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; 2015.
- B. FEMA 412 - Installing Seismic Restraints for Mechanical Equipment; 2002.
- C. FEMA 414 - Installing Seismic Restraints for Duct and Pipe; 2004.
- D. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; Sheet Metal and Air Conditioning Contractors' National Association; 2008.

#### 1.3 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data:
  - 1. Provide manufacturer's product literature documenting compliance with PART 2 PRODUCTS.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Kinetics Noise Control, Inc: [www.kineticsnoise.com](http://www.kineticsnoise.com).
- B. Mason Industries: [www.mason-ind.com](http://www.mason-ind.com).

#### 2.2 PERFORMANCE REQUIREMENTS

- A. General:
  - 1. All vibration isolators, base frames and inertia bases to conform to all uniform deflection and stability requirements under all operating loads.
  - 2. Steel springs to function without undue stress or overloading.

#### 2.3 VIBRATION ISOLATORS

- A. Non-Seismic Type:
  - 1. All Elastomeric-Fiber Glass Pads:
    - a. Configuration: Flat or molded.
    - b. Thickness: 0.25 inch minimum.
    - c. Assembly: Single or multiple layers using bonded, galvanized sheet metal separation plate between each layer with load plate providing evenly distributed load over pad surface.
  - 2. Elastomeric Hangers:
    - a. Housing: Steel construction containing elastomeric isolation element to prevent rod contact with housing and short-circuiting of isolating function.

- b. Incorporate steel load distribution plate sandwiching elastomeric element to housing.
- 3. Spring Hanger:
  - a. Housing: Steel construction containing stable steel spring and integral elastomeric element preventing metal to metal contact.
  - b. Bottom Opening: Sized to allow plus/minus 15 degrees rod misalignment.
- 4. Combination Elastomeric-Spring Hanger:
  - a. Housing: Steel construction containing stable steel spring with elastomeric element in series isolating upper connection of hanger box to building structure.
  - b. Bottom Opening: Sized to allow plus/minus 15 degrees rod misalignment.

## 2.4 ROOF CURBS

- A. Vibration Isolation Curbs:
  - 1. Non-Seismic Curb:
    - a. Location: Between structure and rooftop equipment.
    - b. Construction: Aluminum.
    - c. Integral vibration isolation to conform to requirements of this section.
    - d. Weather exposed components consist of corrosion resistant materials.

## PART 3 EXECUTION

### 3.1 INSTALLATION - GENERAL

- A. Install in accordance with manufacturer's instructions.

END OF SECTION 23 0548

## SECTION 23 0593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Testing, adjustment, and balancing of air systems.
- B. Testing, adjustment, and balancing of hydronic systems.
- C. Measurement of final operating condition of HVAC systems.

#### 1.2 REFERENCE STANDARDS

- A. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008.
- B. NEBB (TAB) - Procedural Standards for Testing Adjusting and Balancing of Environmental Systems; 2015, Eighth Edition.

#### 1.3 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
  - 1. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Engineer and for inclusion in operating and maintenance manuals.
  - 2. Provide reports in soft cover, letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
  - 3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
  - 4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
  - 5. Units of Measure: Report data in I-P (inch-pound) units only.
- C. Project Record Documents: Record actual locations of flow measuring stations and balancing valves and rough setting.

### PART 2 PRODUCTS - NOT USED

### PART 3 EXECUTION

#### 3.1 GENERAL REQUIREMENTS

- A. Perform total system balance in accordance with one of the following:
  - 1. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
  - 2. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.
- B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. TAB Agency Qualifications:

1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.

3.2 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:

1. Systems are started and operating in a safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Hydronic systems are flushed, filled, and vented.
13. Pumps are rotating correctly.
14. Proper strainer baskets are clean and in place.
15. Service and balance valves are open.

B. Beginning of work means acceptance of existing conditions.

3.3 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.

1. Require attendance by all installers whose work will be tested, adjusted, or balanced and by the Temperature Controls Contractor.

B. Provide additional balancing devices as required.

C. Coordinate all trades to properly determine control valve and damper settings and variable frequency drive settings to meet system design and control sequences during all modes of system operation.

3.4 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

D. If system cannot be balanced per design documents, Contractors shall work together towards a solution on the site and be prepared to remedy work as required. If requirements cannot still be attained, the Contractor shall contact Engineer prior to submitting report.

### 3.5 RECORDING AND ADJUSTING

- A. Ensure recorded data represents actual measured or observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

### 3.6 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities by adjusting fan sheaves as needed. If the factory supplied sheave does not allow for the required adjustment, the Contractor shall provide the appropriately sized sheave and belt to meet specified air quantity.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
- G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
- I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
- J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.
- L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.

### 3.7 WATER SYSTEM PROCEDURE

- A. Adjust water systems to provide required or design quantities.

- B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gages to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.
- C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
- D. Effect system balance with automatic control valves fully open to heat transfer elements.
- E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
- F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

### 3.8 SCOPE

- A. Test, adjust, and balance the following:
  - 1. Roof Top Unit.
  - 2. HVAC Pumps.
  - 3. Furnace
  - 4. Exhaust Fans
  - 5. Air Inlets and Outlets.
  - 6. Zone Control Dampers
  - 7. Hot Water Heating Piping

### 3.9 MINIMUM DATA TO BE REPORTED

- A. Electric Motors:
  - 1. Manufacturer.
  - 2. Model/Frame.
  - 3. HP/BHP.
  - 4. Phase, voltage, amperage; nameplate, actual, no load.
  - 5. RPM.
  - 6. Service factor.
  - 7. Starter size, rating, heater elements.
  - 8. Sheave Make/Size/Bore.
- B. V-Belt Drives:
  - 1. Identification/location.
  - 2. Required driven RPM.
  - 3. Driven sheave, diameter and RPM.
  - 4. Belt, size and quantity.
  - 5. Motor sheave diameter and RPM.
  - 6. Center to center distance, maximum, minimum, and actual.
- C. Pumps:
  - 1. Identification/number.
  - 2. Manufacturer.
  - 3. Size/model.
  - 4. Impeller.
  - 5. Service.



6. Design flow rate, pressure drop, BHP.
  7. Actual flow rate, pressure drop, BHP.
  8. Discharge pressure.
  9. Suction pressure.
  10. Total operating head pressure.
  11. Shut off, discharge and suction pressures.
  12. Shut off, total head pressure.
- D. Heating Coils:
1. Identification/number.
  2. Location.
  3. Service.
  4. Air flow, design and actual.
  5. Water flow, design and actual.
  6. Water pressure drop, design and actual.
  7. Entering water temperature, design and actual.
  8. Leaving water temperature, design and actual.
  9. Entering air temperature, design and actual.
  10. Leaving air temperature, design and actual.
  11. Air pressure drop, design and actual.
- E. Air Moving Equipment:
1. Location.
  2. Manufacturer.
  3. Model number.
  4. Serial number.
  5. Arrangement/Class/Discharge.
  6. Air flow, specified and actual.
  7. Return air flow, specified and actual.
  8. Outside air flow, specified and actual.
  9. Total static pressure (total external), specified and actual.
  10. Inlet pressure.
  11. Discharge pressure.
  12. Sheave Make/Size/Bore.
  13. Number of Belts/Make/Size.
  14. Fan RPM.
- F. Return Air/Outside Air:
1. Identification/location.
  2. Design air flow.
  3. Actual air flow.
  4. Return air temperature.
  5. Outside air temperature.
  6. Actual mixed air temperature.
- G. Exhaust Fans:
1. Location.
  2. Manufacturer.
  3. Model number.
  4. Serial number.
  5. Air flow, specified and actual.
  6. Total static pressure (total external), specified and actual.
  7. Sheave Make/Size/Bore.
  8. Number of Belts/Make/Size.

9. Fan RPM.
- H. Duct Traverses:
  1. System zone/branch.
  2. Duct size.
  3. Area.
  4. Design velocity.
  5. Design air flow.
  6. Test velocity.
  7. Test air flow.
  8. Duct static pressure.
- I. Air Distribution Tests:
  1. Air terminal number.
  2. Room number/location.
  3. Terminal type.
  4. Terminal size.
  5. Area factor.
  6. Design velocity.
  7. Design air flow.
  8. Test (final) velocity.
  9. Test (final) air flow.
  10. Percent of design air flow.

END OF SECTION 23 0593

## SECTION 23 0713 - DUCT INSULATION

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Duct insulation.
- B. Duct liner.

#### 1.2 RELATED REQUIREMENTS

- A. Section 23 3100 - HVAC Ducts and Casings.

#### 1.3 REFERENCE STANDARDS

- A. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2014.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- C. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.
- D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.
- E. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

#### 1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

### PART 2 PRODUCTS

#### 2.1 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

#### 2.2 GLASS FIBER, FLEXIBLE

- A. Manufacturer:
  - 1. Knauf Fiber Glass.
  - 2. Johns Manville Corporation.
  - 3. Owens Corning Corp.
  - 4. CertainTeed Corporation.

- B. Vapor Barrier Jacket:
  - 1. Kraft paper with glass fiber yarn and bonded to aluminized film.
  - 2. Moisture Vapor Permeability: 0.029 ng/Pa s m (0.02 perm inch), when tested in accordance with ASTM E96/E96M.
  - 3. Secure with pressure sensitive tape.

## 2.3 DUCT LINER

- A. Manufacturers:
  - 1. Knauf Fiber Glass.
  - 2. Johns Manville Corporation.
  - 3. Owens Corning Corp.
  - 4. CertainTeed Corporation.
- B. Insulation: Incombustible glass fiber complying with ASTM C 1071; flexible blanket; impregnated surface and edges coated with poly vinyl acetate polymer or acrylic polymer shown to be fungus and bacteria resistant by testing to ASTM G 21.
  - 1. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F.
  - 2. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm, minimum.
  - 3. Minimum Noise Reduction Coefficients:
    - a. 1 inch Thickness: 0.45.
    - b. 1-1/2 inches Thickness: 0.60.
    - c. 2 inch Thickness: 0.90.
- C. Adhesive: Waterproof, fire-retardant type, ASTM C916.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that ducts have been tested before applying insulation materials.
- B. Verify that surfaces are clean, foreign material removed, and dry.

### 3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Insulated ducts conveying air below ambient temperature:
  - 1. Provide insulation with vapor barrier jackets.
  - 2. Finish with tape and vapor barrier jacket.
  - 3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
  - 4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.
- C. External Duct Insulation Application:
  - 1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
  - 2. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
  - 3. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
  - 4. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

D. Duct and Plenum Liner Application:

1. Adhere insulation with adhesive for 100 percent coverage.
2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
3. Seal and smooth joints. Seal and coat transverse joints.
4. Seal liner surface penetrations with adhesive.
5. Duct dimensions indicated are net inside dimensions required for air flow. Increase duct size to allow for insulation thickness.

3.3 SCHEDULES

- A. Outside Air Intake Ducts Conveying Untempered Outside Air: 3 inches thick duct wrap insulation.
- B. Supply and Exhaust Ducts: 2.2" inch thick duct wrap insulation.
- C. Supply ducts where shown on drawings 1-1/2 inch thick duct liner.
- D. Return and Transfer Ducts: 1" duct liner.
- E. Spiral Ductwork Exposed in the Conditioned Space It Serves: None.

END OF SECTION 23 0713

## SECTION 23 0913 - INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Thermostats.
- B. Temperature and humidity sensors.
- C. Control valves.
- D. Automatic dampers.
- E. Damper operators.

#### 1.2 RELATED REQUIREMENTS

- A. Section 23 2113 - Hydronic Piping: Installation of control valves, flow switches, temperature sensor sockets, gauge taps.
- B. Section 23 3300 - Air Duct Accessories: Installation of automatic dampers.
- C. Section 26 2726 - Wiring Devices: Elevation of exposed components.

#### 1.3 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.
- C. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.
- D. Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors. Accurately record actual location of control components, including panels, thermostats, and sensors.
- E. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

#### 1.4 QUALITY ASSURANCE

- A. System will require the installation of Andover components of the temperature control/energy management system in addition to other work as specified herein. The installing Contractor shall have factory trained personnel for the application, engineering installation, and programming of the Andover Control System.

### PART 2 PRODUCTS

#### 2.1 EQUIPMENT - GENERAL

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

## 2.2 CONTROL VALVES

- A. Globe Pattern:
  - 1. Up to 2 inches: Bronze body, bronze trim, rising stem, renewable composition disc, screwed ends with backseating capacity repackable under pressure.
  - 2. Over 2 inches: Iron body, bronze trim, rising stem, plug-type disc, flanged ends, renewable seat and disc.
  - 3. Hydronic Systems:
    - a. Rate for service pressure of 125 psig at 250 degrees F.
    - b. Replaceable plugs and seats of stainless steel.
    - c. Size for 3 psig maximum pressure drop at design flow rate.
    - d. Two way valves shall have equal percentage characteristics, three way valves linear characteristics. Size two way valve operators to close valves against pump shut off head.
- B. Electronic Operators:
  - 1. Valves shall spring return to normal position as indicated on freeze, fire, or temperature protection.
  - 2. Select operator for full shut off at maximum pump differential pressure.
- C. Ball Valves:
  - 1. Bronze body, bronze trim, 2 or 3 port as indicated, replaceable plugs and seats, union and threaded ends.
  - 2. Rate for service pressure of 125 psig at 250 degrees F.
  - 3. Size for 3 psig maximum pressure drop at design flow rate.
  - 4. Two way valves shall have equal percentage characteristics, three way valves linear characteristics. Size two way valve operators to close valves against pump shut off head.
  - 5. Operators (2 Position): Synchronous motor with enclosed gear train, dual return springs, valve position indicator; 24 v DC, 0.4 amp. Valves shall spring return to normal position for temperature protection.
  - 6. Operators (Modulating): Self contained, linear motorized actuator with approximately 3/4 inch stroke, 60 second full travel with transformer and SPDT contacts: 24 v DC, 6 watt maximum input.

## 2.3 DAMPERS

- A. Frames: Galvanized steel, welded or riveted with corner reinforcement, minimum 12 gage, 0.1046 inch.
- B. Blades: Galvanized steel, maximum blade size 8 inches wide, 48 inches long, minimum 16 gage, attached to minimum 1/2 inch shafts with set screws. Blades shall be typically opposed blade for control unless mixing is required and then they shall be of parallel configuration.
- C. Blade Seals: Synthetic elastomeric mechanically attached, field replaceable.
- D. Jamb Seals: Spring stainless steel.
- E. Shaft Bearings: Graphite impregnated nylon sleeve, with thrust washers at bearings.
- F. Linkage Bearings: Graphite impregnated nylon.
- G. Leakage: Less than one percent based on approach velocity of 2000 ft/min and 4 inches wg.

## 2.4 DAMPER OPERATORS

- A. General: Provide smooth proportional control with sufficient power for air velocities 20 percent greater than maximum design velocity and to provide tight seal against maximum system pressures. Provide spring return for two position control and for fail safe operation.
- B. Electric Operators:
  - 1. Spring return, adjustable stroke motor having oil immersed gear train, with auxiliary end switch.

## 2.5 INPUT/OUTPUT SENSORS

- A. Temperature Sensors:
  - 1. Resistance temperature detectors with resistance tolerance of plus or minus 0.1 percent at 70 degrees F, interchangeability less than plus or minus 0.2 percent, time constant of 13 seconds maximum for fluids and 200 seconds maximum for air.
  - 2. Use insertion elements in ducts not affected by temperature stratification or smaller than one square meter. Use averaging elements where larger or prone to stratification sensor length 8 feet or 16 feet as required.
  - 3. Insertion elements for liquids shall be with brass socket with minimum insertion length of 2-1/2 inches.
  - 4. Room sensors: Locking cover.
  - 5. Outside air sensors: Watertight inlet fitting, shielded from direct rays of sun.
  - 6. Room sensors: Provide temperature setpoint adjust for +/- 3 deg. (adjustable) of control setpoint and occupied/unoccupied override button.
- B. Humidity Sensors:
- C. Static Pressure Sensors:
  - 1. Unidirectional with ranges not exceeding 150 percent of maximum expected input.
  - 2. Accuracy: One percent of full scale with repeatability 0.3 percent.
- D. Equipment Operation Sensors:
  - 1. Status Inputs for Fans: Differential pressure switch with adjustable range of 0 to 5 inches wg.
  - 2. Status Inputs for Pumps: Differential pressure switch piped across pump with adjustable pressure differential range of 8 to 60 psi.
  - 3. Status Inputs for Electric Motors: Current sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.

## 2.6 THERMOSTATS

- A. Immersion Thermostat:
  - 1. Remote bulb or bimetallic rod and tube type, proportional action with adjustable setpoint and adjustable throttling range.
- B. Airstream Thermostats:
  - 1. Remote bulb or bimetallic rod and tube type, proportional action with adjustable setpoint in middle of range and adjustable throttling range.
- C. Electric Low Limit Duct Thermostat:
  - 1. Snap acting, single pole, single throw, manual reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below setpoint,
  - 2. Provide one thermostat for every 20 sq. ft. of coil surface.



## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that systems are ready to receive work.
- C. Beginning of installation means installer accepts existing conditions.
- D. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.
- E. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

### 3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check and verify location of thermostats with plans and room details before installation. Locate 60 inches above floor. Align with lighting switches and humidistats. Refer to Section 26 2726.
- C. Mount freeze protection thermostats using flanges and element holders.
- D. Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun shield.
- E. Provide separable sockets for liquids and flanges for air bulb elements.
- F. Provide flat plate security sensors on temperature sensors in public areas.
- G. Provide mixing dampers of parallel blade construction arranged to mix streams. Provide opposed blade construction for other air control dampers. Provide pilot positioners on mixed air damper motors.
- H. Install damper motors on outside of duct in warm areas. Do not install motors in locations at outdoor temperatures.
- I. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.
- J. Provide all control wiring in conduit. Conduit and electrical wiring shall be in accordance with Section 26 2717. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

END OF SECTION 23 0913

## SECTION 23 0923 - DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. System description.
- B. HVAC control programs.
- C. Control equipment.
- D. Software.

#### 1.2 RELATED REQUIREMENTS

- A. Section 23 0913 - Instrumentation and Control Devices for HVAC.
- B. Section 23 0993 - Sequence of Operations for HVAC Controls.
- C. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

#### 1.3 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

#### 1.4 SYSTEM DESCRIPTION

- A. Automatic temperature control field monitoring and control system using field programmable micro-processor based units .
- B. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.
- C. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.
- D. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.
- E. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

#### 1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for each system component and software module.
- C. Shop Drawings:
  - 1. Indicate trunk cable schematic showing programmable control unit locations, and trunk data conductors.
  - 2. List connected data points, including connected control unit and input device.
  - 3. Indicate system graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations. Provide demonstration diskette containing graphics.

4. Show system configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
  5. Indicate description and sequence of operation of operating, user, and application software.
- D. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
1. Revise shop drawings to reflect actual installation and operating sequences.
- E. Operation and Maintenance Data:
1. Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
  2. Include keyboard illustrations and step-by-step procedures indexed for each operator function.
  3. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
- 1.6 QUALITY ASSURANCE
- A. Perform work in accordance with NFPA 70.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.
- 1.7 WARRANTY
- A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within a one year period after Substantial Completion.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Honeywell International, Inc: [www.honeywell.com](http://www.honeywell.com).
- B. Johnson Controls, Inc: [www.johnsoncontrols.com](http://www.johnsoncontrols.com).
- C. Siemens AG, Building Technologies Division: [www.siemens.com](http://www.siemens.com).
- D. Andover Controls.

### 2.2 SYSTEM DESCRIPTION

- A. Automatic temperature control field monitoring and control system using field programmable micro-processor based units.
- B. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.
- C. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.
- D. Controls for variable air volume terminals, reheat coils, unit heaters and the like when directly connected to the control units. Individual terminal unit control is specified in Section 23 0913.

- E. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.
- F. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

## 2.3 CONTROLLERS

### A. BUILDING CONTROLLERS

- 1. General:
  - a. Manage global strategies by one or more, independent, standalone, microprocessor based controllers.
  - b. Provide sufficient memory to support controller's operating system, database, and programming requirements.
  - c. Share data between networked controllers.
  - d. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
  - e. Utilize real-time clock for scheduling.
  - f. Continuously check processor status and memory circuits for abnormal operation.
  - g. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.
  - h. Communication with other network devices to be based on assigned protocol.
- 2. Communication:
  - a. Controller to reside on a BACnet network using ISO 8802-3 (ETHERNET) Data Link/Physical layer protocol.
  - b. Perform routing when connected to a network of custom application and application specific controllers.
  - c. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.
- 3. Anticipated Environmental Ambient Conditions:
  - a. Outdoors and/or in Wet Ambient Conditions:
    - 1) Mount within waterproof enclosures.
    - 2) Rated for operation at 40 to 150 degrees F.
  - b. Conditioned Space:
    - 1) Mount within dustproof enclosures.
    - 2) Rated for operation at 32 to 120 degrees F.
- 4. Provisions for Serviceability:
  - a. Diagnostic LEDs for power, communication, and processor.
  - b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
- 5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
- 6. Power and Noise Immunity:
  - a. Maintain operation at 90 to 110 percent of nominal voltage rating.
  - b. Perform orderly shutdown below 80 percent of nominal voltage.
  - c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.

B. APPLICATION SPECIFIC CONTROLLERS

1. General:
  - a. Not fully user programmable, microprocessor based controllers dedicated to control specific equipment.
  - b. Customized for operation within the confines of equipment served.
  - c. Communication with other network devices to be based on assigned protocol.
2. Communication:
  - a. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.
3. Provisions for Serviceability:
  - a. Diagnostic LEDs for power, communication, and processor.
  - b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
4. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.

C. INPUT/OUTPUT INTERFACE

1. Hardwired inputs and outputs tie into the DDC system through building, custom application, or application specific controllers.
2. All Input/Output Points:
  - a. Protect controller from damage resulting from any point short-circuiting or grounding and from voltage up to 24 volts of any duration.
  - b. Provide universal type for building and custom application controllers where input or output is software designated as either binary or analog type with appropriate properties.
3. Binary Inputs:
  - a. Allow monitoring of On/Off signals from remote devices.
  - b. Provide wetting current of 12 mA minimum, compatible with commonly available control devices and protected against the effects of contact bounce and noise.
  - c. Sense dry contact closure with power provided only by the controller.
4. Pulse Accumulation Input Objects: Conform to all requirements of binary input objects and accept up to 10 pulses per second.
5. Analog Inputs:
  - a. Allow for monitoring of low voltage 0 to 10 VDC, 4 to 20 mA current, or resistance signals (thermistor, RTD).
  - b. Compatible with and field configurable to commonly available sensing devices.
6. Binary Outputs:
  - a. Used for On/Off operation or a pulsed low-voltage signal for pulse width modulation control.
  - b. Outputs provided with three position (On/Off/Auto) override switches.
  - c. Status lights for building and custom application controllers to be selectable for normally open or normally closed operation.
7. Analog Outputs:
  - a. Monitoring signal provides a 0 to 10 VDC or a 4 to 20 mA output signal for end device control.
  - b. Provide status lights and two position (AUTO/MANUAL) switch for building and custom application controllers with manually adjustable potentiometer for manual override on building and custom application controllers.
  - c. Drift to not exceed 0.4 percent of range per year.

8. Tri State Outputs:
  - a. Coordinate two binary outputs to control three point, floating type, electronic actuators without feedback.
  - b. Limit the use of three point, floating devices to the following zone and terminal unit control applications:
  - c. Control algorithms run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.
9. System Object Capacity:
  - a. System size to be expandable to twice the number of input output objects required by providing additional controllers, including associated devices and wiring.
  - b. Hardware additions or software revisions for the installed operator interfaces are not to be required for future, system expansions.

#### 2.4 LOCAL AREA NETWORK (LAN)

- A. Provide communication between control units over local area network (LAN).
- B. LAN Capacity: Not less than 60 stations or nodes.
- C. Break in Communication Path: Alarm and automatically initiate LAN reconfiguration.
- D. LAN Data Speed: Minimum 19.2 Kb.
- E. Communication Techniques: Allow interface into network by multiple operation stations and by auto-answer/auto-dial modems. Support communication over telephone lines utilizing modems.
- F. Web Server: Monitor of control system through internet IP address at any remote web browser. Passwords given to Owner and Engineer to provide system operation/monitoring access.
- G. Transmission Median: Fiber optic or single pair of solid 24 gage twisted, shielded copper cable.
- H. Network Support: Time for global point to be received by any station, shall be less than 3 seconds. Provide automatic reconfiguration if any station is added or lost. If transmission cable is cut, reconfigure two sections with no disruption to system's operation, without operator intervention.

#### 2.5 SYSTEM SOFTWARE

- A. Operating System:
  1. Concurrent, multi-tasking capability.
    - a. Common Software Applications Supported: Microsoft Excel.
  2. System Graphics:
    - a. Allow up to 10 graphic screens, simultaneously displayed for comparison and monitoring of system status.
    - b. Animation displayed by shifting image files based on object status.
    - c. Provide method for operator with password to perform the following:
      - 1) Move between, change size, and change location of graphic displays.
      - 2) Modify on-line.
      - 3) Add, delete, or change dynamic objects consisting of:
        - (a) Analog and binary values.
        - (b) Dynamic text.
        - (c) Static text.
        - (d) Animation files.

3. Custom Graphics Generation Package:
  - a. Create, modify, and save graphic files and visio format graphics in PCX formats.
  - b. HTML graphics to support web browser compatible formats.
  - c. Capture or convert graphics from AutoCAD.
- B. Workstation System Applications:
  1. Automatic System Database Save and Restore Functions:
    - a. Current database copy of each Building Controller is automatically stored on hard disk.
    - b. Automatic update occurs upon change in any system panel.
    - c. In the event of database loss in any system panel, the first workstation to detect the loss automatically restores the database for that panel unless disabled by the operator.
  2. Manual System Database Save and Restore Functions by Operator with Password Clearance:
    - a. Save database from any system panel.
    - b. Clear a panel database.
    - c. Initiate a download of a specified database to any system panel.
  3. Software provided allows system configuration and future changes or additions by operators under proper password protection.
  4. On-line Help:
    - a. Context-sensitive system assists operator in operation and editing.
    - b. Available for all applications.
    - c. Relevant screen data provided for particular screen display.
    - d. Additional help available via hypertext.
  5. Security:
    - a. Operator log-on requires user name and password to view, edit, add, or delete data.
    - b. System security selectable for each operator.
    - c. System supervisor sets passwords and security levels for all other operators.
    - d. Operator passwords to restrict functions accessible to viewing and/or changing system applications, editor, and object.
    - e. Automatic, operator log-off results from keyboard or mouse inactivity during user-adjustable, time period.
    - f. All system security data stored in encrypted format.
  6. System Diagnostics:
    - a. Operations Automatically Monitored:
      - 1) Workstations.
      - 2) Printers.
      - 3) Modems.
      - 4) Network connections.
      - 5) Building management panels.
      - 6) Controllers.
    - b. Device failure is annunciated to the operator.
  7. Alarm Processing:
    - a. All system objects are configurable to "alarm in" and "alarm out" of normal state.
    - b. Configurable Objects:
      - 1) Alarm limits.
      - 2) Alarm limit differentials.
      - 3) States.
      - 4) Reactions for each object.

8. Alarm Messages:
  - a. Recognizable Features:
    - 1) Source.
    - 2) Location.
    - 3) Nature.
9. Configurable Alarm Reactions by Workstation and Time of Day:
  - a. Logging.
  - b. Printing.
  - c. Starting programs.
  - d. Displaying messages.
  - e. Dialing out to remote locations.
  - f. Paging.
  - g. Providing audible annunciation.
  - h. Displaying specific system graphics.
10. Custom Trend Logs:
  - a. Definable for any data object in the system including interval, start time, and stop time.
  - b. Trend Data:
    - 1) Sampled and stored on the building controller panel.
    - 2) Archivable on hard disk.
    - 3) Retrievable for use in reports, spreadsheets and standard database programs.
    - 4) Archival on LAN accessible storage media including hard disk, tape, Raid array drive, and virtual cloud environment.
    - 5) Protected and encrypted format to prevent manipulation, or editing of historical data and event logs.
11. Alarm and Event Log:
  - a. View all system alarms and change of states from any system location.
  - b. Events listed chronologically.
  - c. Operator with proper security acknowledges and clears alarms.
  - d. Alarms not cleared by operator are archived to the workstation hard disk.
12. Object, Property Status and Control:
  - a. Provide a method to view, edit if applicable, the status of any object and property in the system.
  - b. Status Available by the Following Methods:
    - 1) Menu.
    - 2) Graphics.
    - 3) Custom Programs.
13. Reports and Logs:
  - a. Reporting Package:
    - 1) Allows operator to select, modify, or create reports.
    - 2) Definable as to data content, format, interval, and date.
    - 3) Archivable to hard disk.
  - b. Real-time logs available by type or status such as alarm, lockout, normal, etc.
  - c. Stored on hard disk and readily accessible by standard software applications, including spreadsheets and word processing.
  - d. Set to be printed on operator command or specific time(s).
14. Reports:
  - a. Standard:
    - 1) Objects with current values.
    - 2) Current alarms not locked out.
    - 3) Disabled and overridden objects, points and SNVTs.



- 4) Objects in manual or automatic alarm lockout.
- 5) Objects in alarm lockout currently in alarm.
- 6) Logs:
  - (a) Alarm History.
  - (b) System messages.
  - (c) System events.
  - (d) Trends.
- b. Electrical, Fuel, and Weather:
  - 1) Electrical Meter(s):
    - (a) Monthly showing daily electrical consumption and peak electrical demand with time and date stamp for each meter.
    - (b) Annual summary showing monthly electrical consumption and peak demand with time and date stamp for each meter.
  - 2) Fuel Meter(s):
    - (a) Monthly showing daily natural gas consumption for each meter.
    - (b) Annual summary showing monthly consumption for each meter.
  - 3) Weather:
    - (a) Monthly showing minimum, maximum, average outdoor air temperature and heating/cooling degree-days for the month.
- C. Workstation Applications Editors:
  - 1. Provide editing software for each system application at PC workstation.
  - 2. Downloaded application is executed at controller panel.
  - 3. Full screen editor for each application allows operator to view and change:
    - a. Configuration.
    - b. Name.
    - c. Control parameters.
    - d. Set-points.
  - 4. Scheduling:
    - a. Monthly calendar indicates schedules, holidays, and exceptions.
    - b. Allows several related objects to be scheduled and copied to other objects or dates.
    - c. Start and stop times adjustable from master schedule.
  - 5. Custom Application Programming:
    - a. Create, modify, debug, edit, compile, and download custom application programming during operation and without disruption of all other system applications.

## 2.6 CONTROLLER SOFTWARE

- A. All applications reside and operate in the system controllers and editing of all applications occurs at the operator workstation.
- B. System Security:
  - 1. User access secured via user passwords and user names.
  - 2. Passwords restrict user to the objects, applications, and system functions as assigned by the system manager.
  - 3. User Log On/Log Off attempts are recorded.
  - 4. Automatic Log Off occurs following the last keystroke after a user defined delay time.

- C. Object or Object Group Scheduling:
  - 1. Weekly Schedules Based on Separate, Daily Schedules:
    - a. Include start, stop, optimal stop, and night economizer.
    - b. 10 events maximum per schedule.
    - c. Start/stop times adjustable for each group object.
  - 2. Exception Schedules:
    - a. Based on any day of the year.
    - b. Defined up to one year in advance.
    - c. Automatically discarded and replaced with standard schedule for that day of the week upon execution.
  - 3. Holiday or Special Schedules:
    - a. Capability to define up to 99 schedules.
    - b. Repeated annually.
    - c. Length of each period is operator defined.
- D. Provide standard application for equipment coordination and grouping based on function and location to be used for scheduling and other applications.
- E. Alarms:
  - 1. Binary object is set to alarm based on the operator specified state.
  - 2. Analog object to have high/low alarm limits.
  - 3. All alarming is capable of being automatically and manually disabled.
  - 4. Alarm Reporting:
    - a. Operator determines action to be taken for alarm event.
    - b. Alarms to be routed to appropriate workstation.
    - c. Reporting Options:
- F. Demand Limiting:
  - 1. Building power consumption monitored from signals generated by a pulse generator, mounted at the building power meter.
  - 2. Demand limit controlled via load shedding or load restoration in a predetermined and predictive manner.
  - 3. Demand Reduction Methods:
  - 4. Relevant variables that influence demand limiting control are based on the power company methodology for computing demand charges.
  - 5. Operator On-Line Changes Allowed:
  - 6. Information and Reports available Hourly, Daily, and Monthly:
- G. Maintenance Management: System monitors equipment status and generates maintenance messages based upon user-designated run-time limits.
- H. Sequencing: Application software based upon specified sequences of operation in Section 23 0993.
- I. PID Control Characteristics:
  - 1. Direct or reverse action.
  - 2. Anti-windup.
  - 3. Calculated, time-varying, analog value, positions an output or stages a series of outputs.
  - 4. User selectable controlled variable, set-point, and PED gains.
- J. Staggered Start Application:
  - 1. Prevents all controlled equipment from simultaneously restarting after power outage.
  - 2. Order of equipment startup is user selectable.

- K. Energy Calculations:
  - 1. Accumulated instantaneous power or flow rates are converted to energy use data.
  - 2. Algorithm calculates a rolling average and allows window of time to be user specified in minute intervals.
  - 3. Algorithm calculates a fixed window average with a digital input signal from a utility meter defining the start of the window period that in turn synchronizes the fixed-window average with that used by the power company.
- L. Anti-Short Cycling:
  - 1. All binary output objects protected from short-cycling.
  - 2. Allows minimum on-time and off-time to be selected.
- M. On-Off Control with Differential:
  - 1. Algorithm allows binary output to be cycled based on a controlled variable and set-point.
  - 2. Algorithm to be direct-acting or reverse-acting incorporating an adjustable differential.
- N. Run-Time Totalization:
  - 1. Totalize run-times for all binary input objects.
  - 2. Provides operator with capability to assign high run-time alarm.

## 2.7 HVAC CONTROL PROGRAMS

- A. Optimal Run Time:
  - 1. Control start-up and shutdown times of HVAC equipment for both heating and cooling.
  - 2. Base on occupancy schedules, outside air temperature, seasonal requirements, and interior room mass temperature.
  - 3. Start-up systems by using outside air temperature, room mass temperatures, and adaptive model prediction for how long building takes to warm up or cool down under different conditions.
  - 4. Use outside air temperature to determine early shut down with ventilation override.
  - 5. Analyze multiple building mass sensors to determine seasonal mode and worse case condition for each day.
- B. Supply Air Reset:
  - 1. Monitor heating and cooling loads in building spaces, terminal reheat systems, unit discharge temperatures.
  - 2. Adjust discharge temperatures to most energy efficient levels satisfying measured load by:
    - a. Raising cooling temperatures to highest possible value.
    - b. Reducing heating temperatures to lowest possible level.
- C. Enthalpy Switchover:
  - 1. Calculate outside and return air enthalpy using measured temperature and relative humidity; determine energy expended and control outside and return air dampers.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices and wiring is installed prior to installation proceeding.

#### 3.2 INSTALLATION

- A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.
- B. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 23 0993.
- C. Provide conduit and electrical wiring in accordance with Section 26 0583. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

#### 3.3 MANUFACTURER'S FIELD SERVICES

- A. Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.
- B. Provide basic operator training for Owner on data display, alarm and status descriptors, requesting data, execution of commands and request of logs. Include a minimum of 16 hours dedicated instructor time. Provide training on site.

#### 3.4 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate complete and operating system to Owner.

#### 3.5 MAINTENANCE

- A. Provide service and maintenance of energy management and control systems for one years from Date of Substantial Completion.

END OF SECTION 23 0923

## SECTION 23 0993 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. This section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other sections.
- B. Sequence of operation for:
  - 1. Air terminal units.
  - 2. Furnace and heat pumps
  - 3. Central fan systems.
  - 4. Heating coils.
  - 5. Mini-split systems
  - 6. Exhaust fans.
  - 7. Hydronic system circulating pumps.
  - 8. Elevator sump pump.

#### 1.2 RELATED REQUIREMENTS

- A. Section 23 0913 - Instrumentation and Control Devices for HVAC.

#### 1.3 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Sequence of Operation Documentation: Submit written sequence of operation for entire HVAC system and each piece of equipment.
- C. Control System Diagrams: Submit graphic schematic of the control system showing each control component and each component controlled, monitored, or enabled.
- D. Points List: Submit list of all control points.
- E. Project Record Documents: Record actual locations of components and setpoints of controls, including changes to sequences made after submission of shop drawings.

### PART 2 PRODUCTS - NOT USED

### PART 3 EXECUTION

#### 3.1 AIR TERMINAL UNITS

- A. Single-duct Variable Volume:
  - 1. Time Schedule: To set occupied and unoccupied temperature set points. Provide optimized control to precondition the space to set-point temperature prior to scheduled occupancy.
  - 2. Cooling with Reheat:
    - a. On a rise in space temperature above the cooling set-point, the unit modulates to its maximum airflow.
    - b. As the space temperature falls below the cooling set-point, the unit modulates to its minimum airflow.
    - c. As the space temperature continues to fall to the heating set-point, the terminal modulates to its heating minimum airflow. At this point, the hot water valve shall modulate till fully open, if the space temperature is not satisfied with the hot

water valve fully open, the airflow shall modulate up till the space temperature is satisfied.

3. Temperature setback: During unoccupied times the space temperature set-point shall be provided with a 5 deg. (adjustable) temperature setback.

### 3.2 HOT WATER HEATING SYSTEMS

- A. Energize hot water heating system pump to start. Modulate the pump VFDs to maintain system differential pressure.
  1. Hot water bypass valve to modulate to maintain maximum differential pressure when the pump VFD is at minimum speed.
- B. Energize boilers. Boilers shall start/stop to maintain hot water heating system temperature. Provide lead/lag operation with equal run-time procedures.
- C. The boilers shall be provided with standalone controls, and communicate and provide all available points through BACnet connection.
- D. System water temperature shall be reset based on outside air temperature.
- E. Display:
  1. System graphic.
  2. Hot water heating pump on/off, speed, pump selection and indication.
  3. Boiler on/off indication.
  4. Hot water heating system supply and return temperature.
  5. Hot water heating system control point adjustment.

### 3.3 FURNACE AND AIR SOURCE HEAT PUMPS

- A. Dual temperature room sensor maintains constant space temperature by cycling the compressor and operating the reversing valve in the heat pump for heating or cooling.
- B. Determine compressor status by current sensing devices. If compressor fails to start as commanded after three tries, signal alarm and lock out the unit until manually reset.
- C. Auxiliary Heat: The heat pump shall be used as the primary means of the heating. If the heat pump cannot maintain space temperature, the auxiliary gas heat shall cycle to maintain space temperature. When the outside air temperature drops below 30 deg. (adjustable), the auxiliary gas heat shall cycle as required to maintain space set-point.
- D. Time Schedule: Start and stop supply fan. Determine fan and compressor status by current sensing devices. If fan or compressor fails to start as commanded after three tries, signal alarm and lock out the unit until manually reset.
- E. Provide the following alarm points for each heat pump:
  1. Low refrigerant pressure.
  2. High refrigerant pressure.
  3. Compressor status.
- F. Display:
  1. System graphic.
  2. System on/off indication.
  3. Compressor(s) on/off indication.
  4. Space temperature setpoint indication.
  5. Space temperature sensor indication.
  6. Unit alarm indication.
  7. Reversing valve indication.
  8. Auxiliary gas heat on.

### 3.4 CENTRAL FAN SYSTEMS (ROOF TOP UNIT)

- A. Time Schedule: Start and stop supply fan. Determine fan status by current sensing devices. If fan fails to start as commanded, signal alarm.
- B. Controls: The unit shall be provided with standalone controls and BACnet over MSTP communication to relay all points and set-points to the BMS.
  - 1. The factory controller shall modulate and stage the compressor(s) as required to maintain the discharge air temperature set-point.
  - 2. The factory controller shall modulate the gas heating as required to maintain the discharge air temperature set-point.
  - 3. The factory controller shall modulate the outside air, return and mixed air dampers as required to maintain CO2 level, and economizer operation.
- C. Maintain constant supply static pressure of 1.5 inches wg by modulating supply fan speed in sequence. Locate sensor minimum 50 ft downstream of supply fan in supply air duct.
- D. Display:
  - 1. System graphic.
  - 2. System on/off indication.
  - 3. System fan on/off indication.
  - 4. Relief fan on/off indication.
  - 5. Outside air temperature indication.
  - 6. Mixed air temperature indication.
  - 7. Fan discharge air temperature indication.
  - 8. Reheat zone air temperature indication.
  - 9. Fan discharge temperature control point adjustment.
  - 10. Return humidity control point adjustment.
  - 11. Supply static pressure indication.
  - 12. Supply static pressure control point adjustment.
  - 13. Supply fan speed.
  - 14. Building static pressure indication.
  - 15. Building static pressure control point adjustment.

### 3.5 MINI-SPLIT SYSTEM

- A. The mini-split system shall be provided with standalone controls and modulate/cycle as required to maintain space temperature.
- B. Provide BACnet communication to indicate all points, and system alarms.

### 3.6 ELEVATOR SUMP PUMP

- A. Provide high water alarm.

### 3.7 EXHAUST FANS

- A. Energize exhaust fans as scheduled.
- B. Monitor all fans for failure and alarm.

### 3.8 POINTS LIST

- A. Refer to the following pages for "Input/Output Summary" for listing of required control points.
- B. All control points shall be addressed according to actual mechanical equipment identification numbers and room numbers.

END OF SECTION 23 0993

# Input/Output Summary

	Indication and Control											General			Remarks
	Analog							Digital							
	Temperature	Humidity	Pressure	Air Flow	Kilowatt-Hours	Modulation		Start/Stop	Status/Alarm	Open/Close	Staging		Color	Graphic	
VAV RTU								X					X		All BACnet points
Supply Air	X	X	X												
Return Air	X	X													
Mixed Air	X														
Outside Air	X	X													
Economizer								X	X						Enthalpy Control
RA/FA/MA Dampers									X						
Supply/Relief Fans				X		X		X	X						VFD Control
Filter			X												
RA CO2									X						Modulate FA
DX Cooling									X		X				
Gas Heating						X			X						
Phase monitoring									X						
VAV Boxes													X		
Space Sensor	X	X													
Discharge Temp.	X								X						
CFM				X											Calculated value
Hot water valve						X									
Damper						X									



# Input/Output Summary

	Indication and Control											General			Remarks	
	Analog							Digital								
	Temperature	Humidity	Pressure	Air Flow	Kilowatt-Hours	Modulation		Start/Stop	Status/Alarm	Open/Close	Staging		Color	Graphic		
Hot Water System								X					X			
System Supply	X								X							
System Return	X															
Pumps (P-1 & P-2)						X		X	X							Alternate pumps
Diff. Pressure			X						X							
Bypass valve						X										
Boilers (B-1 & B-2)	X					X		X	X							All BACnet points
Furnace & HP									X				X			
Space Sensor	X															
Fan								X								
HP								X	X							
Reversing valve									X		X					Heating/Cooling
Supply Air	X															
Auxiliary heat								X								
Ductless Split System													X			
Space Sensor	X	X							X							
Exhaust Fans								X	X							
Sump Pump									X							

## SECTION 23 2113 - HYDRONIC PIPING

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Hydronic system requirements.
- B. Heating water piping, above grade.
- C. Equipment drains and overflows.
- D. Pipe hangers and supports.
- E. Unions, flanges, mechanical couplings, and dielectric connections.
- F. Valves:
  - 1. Ball valves.
  - 2. Butterfly valves.
  - 3. Check valves.

#### 1.2 RELATED REQUIREMENTS

- A. Section 08 3100 - Access Doors and Panels.
- B. Section 22 0516 - Expansion Fittings and Loops for Plumbing Piping.
- C. Section 22 0553 - Identification for Mechanical Piping and Equipment.
- D. Section 22 0719 - Mechanical Piping Insulation.
- E. Section 23 2114 - Hydronic Specialties.
- F. Section 23 2500 - HVAC Water Treatment: Pipe cleaning.

#### 1.3 REFERENCE STANDARDS

- A. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; 2015.
- B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2011.
- C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.
- D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.
- E. ASME B31.9 - Building Services Piping; 2014.
- F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.
- G. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- H. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2015.
- I. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984 (Reapproved 2014).
- J. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).
- K. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2014.

- L. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2013.
- M. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992 (Reapproved 2008).
- N. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications; 2007 (Reapproved 2013).
- O. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011-AMD 1.
- P. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.
- Q. AWWA C606 - Grooved and Shouldered Joints; 2011.
- R. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

#### 1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data:
  - 1. Include data on pipe materials, pipe fittings, valves, and accessories.
- C. Project Record Documents: Record actual locations of valves.
- D. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

#### 1.5 QUALITY ASSURANCE

- A. Provide all grooved joint couplings, fittings, valves, specialties, and grooving tools from a single manufacturer. All castings used shall be date stamped for quality assurance and traceability.
- B. Welder Qualifications: Certify in accordance with ASME BPVC-IX.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

### PART 2 PRODUCTS

#### 2.1 HYDRONIC SYSTEM REQUIREMENTS

- A. Comply with ASME B31.9 and applicable federal, state, and local regulations.
- B. Piping: Provide piping, fittings, hangers and supports as required, as indicated, and as follows:
  - 1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.

2. Use non-conducting dielectric connections (Clear-Flow nipples or dielectric flanges) whenever jointing dissimilar metals.
  3. Make hydronic piping branch taps off of the top of the system mains.
  4. Grooved mechanical joints may be used in accessible locations only.
    - a. Accessible locations include those exposed on interior of building, in pipe chases, and in mechanical rooms, aboveground outdoors, and as approved by Engineer.
    - b. Use rigid joints unless otherwise indicated.
  5. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.
- C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.
- D. Valves: Provide valves where indicated:
1. Provide drain valves where indicated, and if not indicated provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch ball valves with cap; pipe to nearest floor drain.
  2. Isolate equipment using butterfly valves with lug end flanges or grooved mechanical couplings.
  3. For throttling, bypass, or manual flow control services, use globe, ball, or butterfly valves.
  4. For shut-off and to isolate parts of systems or vertical risers, use ball or butterfly valves.
- E. Welding Materials and Procedures: Conform to ASME BPVC-IX.
- ## 2.2 HEATING WATER PIPING, ABOVE GRADE
- A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, using one of the following joint types:
1. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.
  2. Threaded Joints (only allowed up to 2" size): ASME B16.3, malleable iron fittings.
  3. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.
- B. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), drawn, using one of the following joint types:
1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings.
    - a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
    - b. Braze: AWS A5.8/A5.8 BCuP copper/silver alloy.
    - c. Braze: AWS A5.8/A5.8M BCuP copper/silver alloy. Braze all piping joints 2" and larger.
  2. Grooved Joints: AWWA C606 grooved tube, fittings of same material, and copper-tube-dimension mechanical couplings.
- ## 2.3 EQUIPMENT DRAINS AND OVERFLOWS
- A. Steel Pipe: ASTM A53/A53M, Schedule 40 galvanized; using one of the following joint types:
1. Threaded Joints: Galvanized cast iron, or ASME B16.3 malleable iron fittings.

- B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn; using one of the following joint types:
  - 1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.

## 2.4 PIPE HANGERS AND SUPPORTS

- A. Provide hangers and supports that comply with MSS SP-58 and ASME B31.9.
  - 1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
  - 2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron, adjustable swivel, split ring.
  - 3. Hangers for Cold Pipe Sizes 2 Inches and Greater: Carbon steel, adjustable, clevis.
  - 4. Hangers for Hot Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis.
  - 5. Hangers for Hot Pipe Sizes 6 Inches and Greater: Adjustable steel yoke, cast iron roll, double hanger.
  - 6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
  - 7. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
  - 8. Wall Support for Pipe Sizes 4 Inches and Greater: Welded steel bracket and wrought steel clamp.
  - 9. Vertical Support: Steel riser clamp.
  - 10. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
  - 11. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
  - 12. Floor Support for Hot Pipe Sizes 6 Inches and Greater: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
  - 13. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
  - 14. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
  - 15. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.
- B. In grooved installations, use rigid couplings with offsetting angle-pattern bolt pads or with wedge shaped grooves in header piping to permit support and hanging in accordance with ASME B31.9.
- C. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:
  - 1. Bases: High density polypropylene.
  - 2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
  - 3. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
  - 4. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.
  - 5. Height: Provide minimum clearance of 6 inches under pipe to top of roofing.

## 2.5 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

- A. Unions for Pipe 2 Inches and Less:
  - 1. Ferrous Piping: 150 psig malleable iron, threaded.
  - 2. Copper Pipe: Bronze, soldered joints.

- B. Flanges for Pipe 2 Inches and Greater:
  - 1. Ferrous Piping: 150 psig forged steel, slip-on.
  - 2. Copper Piping: Bronze.
  - 3. Gaskets: 1/16 inch thick preformed neoprene.
- C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
  - 1. Dimensions and Testing: In accordance with AWWA C606.
  - 2. Mechanical Couplings: Comply with ASTM F1476.
  - 3. Housing Material: Ductile iron, galvanized complying with ASTM A536.
  - 4. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
  - 5. When pipe is field grooved, provide coupling manufacturer's grooving tools.
- D. Dielectric Connections:
  - 1. Waterways:
    - a. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
    - b. Dry insulation barrier able to withstand 600 volt breakdown test.
    - c. Construct of galvanized steel with threaded end connections to match connecting piping.
    - d. Suitable for the required operating pressures and temperatures.
  - 2. Flanges:
    - a. Dielectric flanges with same pressure ratings as standard flanges.
    - b. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
    - c. Dry insulation barrier able to withstand 600 volt breakdown test.
    - d. Construct of galvanized steel with threaded end connections to match connecting piping.
    - e. Suitable for the required operating pressures and temperatures.

## 2.6 GLOBE OR ANGLE VALVES

- A. Manufacturers:
  - 1. Milwaukee Valve Company: [www.milwaukeevalve.com](http://www.milwaukeevalve.com).
  - 2. Apollo Valve

## 2.7 BALL VALVES

- A. Manufacturers:
  - 1. Milwaukee Valve Company: [www.milwaukeevalve.com](http://www.milwaukeevalve.com).
  - 2. Apollo Valve
  - 3. Victaulic Company: [www.victaulic.com](http://www.victaulic.com).
- B. Up To and Including 2 Inches:
  - 1. Bronze one piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder ends with union.

## 2.8 BUTTERFLY VALVES

- A. Manufacturers:
  - 1. Crane Co.: [www.craneco.com](http://www.craneco.com).
  - 2. Victaulic Company: [www.victaulic.com](http://www.victaulic.com).
- B. Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer, lug, or grooved ends, extended neck.

- C. Disc: Construct of aluminum bronze, chrome plated ductile iron, stainless steel, ductile iron with EPDM encapsulation, or Buna-N encapsulation.
- D. Operator: 10 position lever handle.

## 2.9 SWING CHECK VALVES

- A. Manufacturers:
  - 1. Milwaukee Valve Company: [www.milwaukeevalve.com](http://www.milwaukeevalve.com).
  - 2. Victaulic Company: [www.victaulic.com](http://www.victaulic.com).
- B. Up To and Including 2 Inches:
  - 1. Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder ends.
- C. Over 2 Inches:
  - 1. Iron body, bronze trim, bronze or bronze faced rotating swing disc, renewable disc and seat, flanged or grooved ends.

## 2.10 SPRING LOADED CHECK VALVES

- A. Manufacturers:
  - 1. Crane Co.: [www.craneco.com](http://www.craneco.com).
  - 2. Milwaukee Valve Company: [www.milwaukeevalve.com](http://www.milwaukeevalve.com).
  - 3. Victaulic Company: [www.victaulic.com](http://www.victaulic.com).
- B. Iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer or threaded lug ends.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Prepare pipe for grooved mechanical joints as required by coupling manufacturer.
- C. Remove scale and dirt on inside and outside before assembly.
- D. Prepare piping connections to equipment using jointing system specified.
- E. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
- F. After completion, flush, clean, fill, and treat systems with specified fluid with corrosion inhibitors. Refer to Section 23 2500 for additional requirements.
- G. Refer to Division 22 0000 for piping insulation and identification.

### 3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install heating water, to ASME B31.9 requirements.
- C. Route piping in orderly manner, parallel to building structure, and maintain gradient.
- D. Install piping to conserve building space and to avoid interfere with use of space.
- E. Group piping whenever practical at common elevations.

- F. Sleeve pipe passing through partitions, walls and floors constructed of a minimum of 18 gauge sheetmetal. Provide schedule 40 pipe as sleeves with appropriate sealant at fire and/or smoke rated penetrations around pipe sleeve. Extend sleeves through floors a minimum of 2" above the floor. Wall sleeves shall be flush with the wall and chrome plated solid steel escutcheons shall be installed..
- G. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified.
- H. Slope piping and arrange to drain at low points.
- I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 22 0516.
- J. Grooved Joints:
  - 1. Install in accordance with the manufacturer's latest published installation instructions. All installations shall be done by factory-trained field personnel. Contractor shall remove and replace any improperly installed products.
  - 2. Gaskets to be suitable for the intended service, molded, and produced by the coupling manufacturer.
  - 3. Use grooved mechanical couplings and fasteners only in accessible locations.
- K. Inserts:
  - 1. Provide inserts for placement in concrete formwork.
  - 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
  - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
  - 4. Where concrete slabs form finished ceiling, locate inserts to project 1" above slab surface.
  - 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
- L. Pipe Hangers and Supports:
  - 1. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-58.
  - 2. Support horizontal piping as scheduled.
  - 3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
  - 4. Place hangers within 12 inches of each horizontal elbow.
  - 5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
  - 6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
  - 7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
  - 8. Provide copper plated hangers and supports for copper piping.
  - 9. Prime coat exposed steel hangers and supports. Refer to Section 09 9123. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- M. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 0719.
- N. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 3100.



- O. Use eccentric reducers to maintain top of pipe level.
- P. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
- Q. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting. Refer to Section 09 9123.
- R. Install valves with stems upright or horizontal, not inverted.
- S. Hydrostatically test all hydronic piping systems with 125 psi of water pressure for 24 hours.
- T. Testing of mechanical piping systems shall be witnessed by the Engineer. Provide a minimum of 24 hours notice prior to the testing.

### 3.3 SCHEDULES

- A. Hanger Spacing for Copper Tubing.
  - 1. 1/2 inch and 3/4 inch: Maximum span, 5 feet; minimum rod size, 1/4 inch.
  - 2. 1 inch: Maximum span, 6 feet; minimum rod size, 1/4 inch.
  - 3. 1-1/2 inch and 2 inch: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  - 4. 2-1/2 inch: Maximum span, 9 feet; minimum rod size, 3/8 inch.
- B. Hanger Spacing for Steel Piping.
  - 1. 1/2 inch, 3/4 inch, and 1 inch: Maximum span, 7 feet; minimum rod size, 1/4 inch.
  - 2. 1-1/4 inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  - 3. 1-1/2 inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
  - 4. 2 inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
  - 5. 2-1/2 inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.
  - 6. 3 inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.
  - 7. 4 inches: Maximum span, 14 feet; minimum rod size, 1/2 inch.

END OF SECTION 23 2113

## SECTION 23 2114 - HYDRONIC SPECIALTIES

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Expansion tanks.
- B. Air vents.
- C. Air separators.
- D. Strainers.
- E. Pressure-temperature test plugs.
- F. Combination flow controls.
- G. Relief valves.

#### 1.2 RELATED REQUIREMENTS

- A. Section 23 2113 - Hydronic Piping.
- B. Section 23 2500 - HVAC Water Treatment: Pipe cleaning.

#### 1.3 REFERENCE STANDARDS

- A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; 2015.

#### 1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description and model.
- C. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.
- D. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

## PART 2 PRODUCTS

### 2.1 EXPANSION TANKS

- A. Manufacturers:
  - 1. Amtrol Inc: [www.amtrol.com](http://www.amtrol.com).
  - 2. ITT Bell & Gossett: [www.bellgossett.com](http://www.bellgossett.com).
  - 3. Taco, Inc: [www.taco-hvac.com](http://www.taco-hvac.com).
- B. Construction: Welded steel, tested and stamped in accordance with ASME (BPV VIII, 1); supplied with National Board Form U-1, rated for working pressure of 125 psi, with flexible EPDM diaphragm or removable butyl bladder in tank, and steel support stand.
- C. Accessories: Pressure gage and air-charging fitting, tank drain; precharge to 12 psi.

### 2.2 AIR VENTS

- A. Float Type:
  - 1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.

### 2.3 AIR SEPARATORS

- A. Coalescing Air/Dirt Separators:
  - 1. Manufacturers:
    - a. Spirotherm, Inc: [www.spirotherm.com](http://www.spirotherm.com).
    - b. Taco, Inc: [www.taco-hvac.com](http://www.taco-hvac.com).
    - c. Amtrol Inc.
  - 2. Tank: Fabricated steel tank; tested and stamped in accordance with ASME BPVC-VIII-1; for 150 psi operating pressure and 270 degrees F maximum operating temperature; subject to the requirements of the application and the manufacturer's standard maximum operating conditions.
  - 3. Coalescing Medium: Provide structured copper or stainless steel medium filling the entire vessel to suppress turbulence and provide air elimination efficiency of 100 percent free air, 100 percent entrained air, and 99.6 percent dissolved air at the installed location.
  - 4. Air Vent: Integral float actuated air vent at top fitting of tank rated at 150 psi, threaded to the top of the separator.
  - 5. Inlet and Outlet Connections: Threaded for 2 NPS and smaller; Class 150 flanged connections for 2-1/2 NPS and larger.
  - 6. Blowdown Connection: Threaded.
  - 7. Size: Match system flow capacity.

### 2.4 STRAINERS

- A. Manufacturers:
  - 1. Armstrong International, Inc: [www.armstronginternational.com](http://www.armstronginternational.com).
  - 2. Taco, Inc.
  - 3. Victaulic Company.
- B. Size 2 inch and Under:
  - 1. Screwed brass or iron body for 175 psi working pressure, Y pattern with 1/32 inch stainless steel perforated screen.
- C. Size 2-1/2 inch to 4 inch:

1. Provide flanged or grooved iron body for 175 psi working pressure, Y pattern with 3/64 inch stainless steel perforated screen.
- D. Size 5 inch and Larger:
  1. Provide flanged or grooved iron body for 175 psi working pressure, basket pattern with 1/8 inch stainless steel perforated screen.

## 2.5 PRESSURE-TEMPERATURE TEST PLUGS

- A. Construction: Brass body designed to receive temperature or pressure probe with removable protective cap, and Neoprene rated for minimum 200 degrees F.
- B. Application: Use extended length plugs to clear insulated piping.

## 2.6 COMBINATION FLOW CONTROLS

- A. Manufacturers:
  1. Griswold Flow Controls
- B. Construction: Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet with blowdown/backflush drain.
- C. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.
- D. Control Mechanism: Stainless steel or nickel plated brass piston or regulator cup, operating against stainless steel helical or wave formed spring.
- E. Accessories: In-line strainer on inlet and ball valve on outlet.

## 2.7 RELIEF VALVES

- A. Manufacturers:
  1. Armstrong International, Inc: [www.armstronginternational.com](http://www.armstronginternational.com).
  2. ITT Bell & Gossett: [www.bellgossett.com](http://www.bellgossett.com).
- B. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install specialties in accordance with manufacturer's instructions.
- B. Provide manual air vents at system high points and as indicated.
- C. Provide air/dirt separator on suction side of system circulation pump and connect to expansion tank.
- D. Provide valved drain and hose connection on strainer blow down connection.
- E. Provide temporary strainers during flushing and cleaning, and remove temporary strainers after cleaning systems.
- F. Support pump fittings with floor mounted pipe and flange supports.
- G. Provide relief valves on pressure tanks, low pressure side of reducing valves, heat exchangers, and expansion tanks.

- H. Pipe relief valve outlet to nearest floor drain.

### 3.2 MAINTENANCE

- A. See Section 01 7000 - Execution Requirements, for additional requirements relating to maintenance service.
- B. Provide service and maintenance of hot water system for one year from date of Substantial Completion at no extra charge to Owner.
- C. Explain corrective actions to Owner's maintenance personnel in person.

END OF SECTION 23 2114

## SECTION 23 2123 - HYDRONIC PUMPS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. In-line circulators.
- B. Vertical in-line pumps.

#### 1.2 RELATED REQUIREMENTS

- A. Section 22 0548 - Vibration and Seismic Controls for Mechanical Piping and Equipment.
- B. Section 22 0719 - Mechanical Piping Insulation.
- C. Section 23 0513 - Common Motor Requirements for HVAC Equipment.
- D. Section 23 0719 - HVAC Piping Insulation.
- E. Section 23 2113 - Hydronic Piping.
- F. Section 23 2114 - Hydronic Specialties.
- G. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

#### 1.3 REFERENCE STANDARDS

- A. NEMA MG 1 - Motors and Generators; 2014.
- B. UL 778 - Standard for Motor-Operated Water Pumps; Current Edition, Including All Revisions.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

#### 1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.
- C. Millwright's Certificate: Certify that base mounted pumps have been aligned.
- D. Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

#### 1.6 QUALITY ASSURANCE

- A. Alignment: Base mounted pumps shall be aligned by qualified millwright.

#### 1.7 EXTRA MATERIALS

- A. See Section 01 6000 - Product Requirements, for additional provisions.
- B. Provide one set of mechanical seals for each pump.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Armstrong Pumps Inc.
- B. ITT Bell & Gossett.
- C. Paco Pumps.
- D. Taco. Inc.

### 2.2 HVAC PUMPS - GENERAL

- A. Provide pumps that operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
- B. Products Requiring Electrical Connection: Listed and classified by UL or testing agency acceptable to Authority Having Jurisdiction as suitable for the purpose specified and indicated.

### 2.3 VERTICAL IN-LINE PUMPS

- A. Type: Vertical, single stage, split coupled, radially or horizontally split casing, for in-line mounting, for 175 psi working pressure.
- B. Casing: Cast iron, with suction and discharge gage port, casing wear ring, seal flush connection, drain plug, flanged suction and discharge.
- C. Impeller: Bronze, fully enclosed, keyed directly to motor shaft or extension.
- D. Shaft: Carbon steel with stainless steel impeller cap screw or nut and bronze sleeve.
- E. Seal: Mechanical seal, 225 degrees F maximum continuous operating temperature.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Verify that electric power is available and of the correct characteristics.

### 3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide access space around pumps for service. Provide no less than minimum space recommended by manufacturer.
- C. Provide line sized shut-off valve and strainer on pump suction, and line sized soft seat check valve and balancing valve and shutoff valve on pump discharge.
- D. Provide phenolic sphere type flexible piping connectors in pump suction and discharge piping.
- E. Provide air cock and drain connection on horizontal pump casings.
- F. Provide drains for bases and seals, piped to and discharging into floor drains.
- G. Lubricate pumps before start-up.

END OF SECTION 23 2123

## SECTION 23 2500 - HVAC WATER TREATMENT

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Materials.
  - 1. System cleaner.
  - 2. Closed system treatment (water).
- B. By-pass (pot) feeder.

#### 1.2 RELATED REQUIREMENTS

- A. Section 23 2113 - Hydronic Piping.
- B. Section 23 2114 - Hydronic Specialties.

#### 1.3 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.
- C. Operation and Maintenance Data: Include data on chemical feed pumps, agitators, and other equipment including spare parts lists, procedures, and treatment programs. Include step by step instructions on test procedures including target concentrations.

#### 1.4 REGULATORY REQUIREMENTS

- A. Conform to applicable code for addition of non-potable chemicals to building mechanical systems and to public sewage systems.
- B. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

#### 1.5 MAINTENANCE SERVICE

- A. Furnish service and maintenance of treatment systems for one year from Date of Substantial Completion.
- B. Include two hour training course for operating personnel, instructing them on installation, care, maintenance, testing, and operation of water treatment systems. Arrange course at start-up of systems.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

- A. System Cleaner:
  - 1. Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products; sodium tripoly phosphate and sodium molybdate.
- B. Closed System Treatment (Water):
  - 1. Manufacturers:
    - a. Fremont Industries #927 or approved equal.
  - 2. Product shall be registered by NSF for Nonfood Compounds as an acceptable water conditioner for the treatment of entire potable water systems at



concentrations not to exceed 10 ppm calculated as phosphate ion in and around food processing areas.

3. Sequestering agent to reduce deposits and adjust pH; polyphosphate.
4. Corrosion inhibitors; boron-nitrite, sodium nitrite and borax, sodium tolyltriazole, low molecular weight polymers, phosphonates, sodium molybdate, or sulphites.
5. Conductivity enhancers; phosphates or phosphonates.

## 2.2 BY-PASS (POT) FEEDER

- A. Manufacturers:
  1. Griswold Controls.
  2. J. L. Wingert Company.
- B. 2 quart quick opening cap for working pressure of 175 psi.

## PART 3 EXECUTION

### 3.1 PREPARATION

- A. Systems shall be operational, flushed, filled, started, and vented prior to cleaning. Use water meter to record capacity in each system.
- B. Place terminal control valves in open position during cleaning.
- C. Verify that electric power is available and of the correct characteristics.

### 3.2 CLEANING SEQUENCE

- A. Concentration:
  1. As recommended by manufacturer.
- B. Hot Water Heating Systems:
  1. Apply heat while circulating, slowly raising temperature to 160 degrees F and maintain for 12 hours minimum.
  2. Remove heat and circulate to 100 degrees F or less; drain systems as quickly as possible and refill with clean water.
  3. Circulate for 6 hours at design temperatures, then drain.
  4. Refill with clean water and repeat until system cleaner is removed. Final system fill shall be with softened water.
- C. Use neutralizer agents on recommendation of system cleaner supplier and approval of Engineer.
- D. Flush open systems with clean water for one hour minimum. Drain completely and refill.
- E. Remove, clean, and replace strainer screens.
- F. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

### 3.3 CLOSED SYSTEM TREATMENT

- A. Provide one bypass feeder on each system. Install isolating and drain valves and necessary piping. Install around balancing valve downstream of circulating pumps unless indicated otherwise.
- B. Introduce closed system treatment through bypass feeder when required or indicated by test.

### 3.4 CLOSEOUT ACTIVITIES

- A. Training: Train Owner's personnel on operation and maintenance of chemical treatment system.
  - 1. Provide minimum of two hours of instruction for two people.
  - 2. Have operation and maintenance data prepared and available for review during training.
  - 3. Conduct training using actual equipment after treated system has been put into full operation.

END OF SECTION 23 2500

## SECTION 23 3100 - HVAC DUCTS AND CASINGS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Metal ductwork.
- B. Nonmetal ductwork.

#### 1.2 RELATED REQUIREMENTS

- A. Section 23 0713 - Duct Insulation: External insulation and duct liner.
- B. Section 23 3300 - Air Duct Accessories.
- C. Section 23 3600 - Air Terminal Units.
- D. Section 23 3700 - Air Outlets and Inlets.

#### 1.3 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.
- D. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.
- F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.
- G. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2014.
- H. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.
- I. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

#### 1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

#### 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

## 1.6 REGULATORY REQUIREMENTS

- A. Construct ductwork to NFPA 90A and NFPA 96 standards.

## PART 2 PRODUCTS

### 2.1 DUCT ASSEMBLIES

- A. Regulatory Requirements: Construct ductwork to NFPA 90A standards.
- B. All Ducts: 2 inch w.g. pressure class, galvanized steel, unless otherwise indicated.
- C. General Exhaust: 1 inch w.g. pressure class, galvanized steel.
- D. Outside Air Intake: 1/2 inch w.g. pressure class, galvanized steel.

### 2.2 MATERIALS

- A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.
- B. Aluminum for Ducts: ASTM B209 (ASTM B209M); aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061-T651 or of equivalent strength.
- C. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
  - 1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
  - 2. VOC Content: Not more than 250 g/L, excluding water.
  - 3. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
  - 4. For Use With Flexible Ducts: UL labeled.
- D. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

### 2.3 DUCTWORK FABRICATION

- A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.
- B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.
- C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.
- D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
- E. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

### 2.4 MANUFACTURED DUCTWORK AND FITTINGS

- A. Flat Oval and Spiral Round Ducts: Machine made from round spiral lockseam duct.
  - 1. Manufacture in accordance with SMACNA (DCS).
  - 2. Fittings: Manufacture at least two gages heavier metal than duct.
  - 3. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

- B. Flexible Ducts: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound spring steel wire.
  - 1. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.
  - 2. Maximum Velocity: 4000 fpm.
  - 3. Temperature Range: Minus 20 degrees F to 210 degrees F.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

- A. Install, support, and seal ducts in accordance with SMACNA (DCS).
- B. Install in accordance with manufacturer's instructions.
- C. Provide all ductwork offsets and fittings as required for a quality installation.
- D. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- E. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.
- F. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- G. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- H. Connect terminal units directly to the supply ducts, provide a minimum of 5 pipe diameters of ductwork that matches the inlet size of the terminal unit.
- I. Connect flexible ducts to metal ducts with liquid adhesive plus tape.
- J. Connect diffusers to low pressure ducts with 3 feet maximum length of flexible duct held in place with strap or clamp.
- K. At exterior wall louvers, seal duct to louver frame . See detail on Drawings.
- L. Provide approved method of sealing ductwork penetrations through fire and/or smoke rated walls and barriers with an intumescent sealant or caulk.
- M. For installation of exposed spiral ductwork, hang with stainless steel braided cable system or as detailed otherwise on the Drawings. Provide gasketed fitting between duct sections.
- N. Seal all supply duct connections to furnaces, roof top units, vav boxes, etc.

END OF SECTION 23 3100

## SECTION 23 3300 - AIR DUCT ACCESSORIES

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Air turning devices.
- B. Backdraft dampers.
- C. Duct access doors.
- D. Duct test holes.
- E. Fire dampers.
- F. Flexible duct connections.
- G. Volume control dampers.
- H. Miscellaneous products:
  - 1. Duct opening closure film.

#### 1.2 RELATED REQUIREMENTS

- A. Section 23 0548 - Vibration and Seismic Controls for HVAC Piping and Equipment.
- B. Section 23 3100 - HVAC Ducts and Casings.
- C. Section 23 3600 - Air Terminal Units: Pressure regulating damper assemblies.

#### 1.3 REFERENCE STANDARDS

- A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.
- B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.
- C. UL 33 - Safety Heat Responsive Links for Fire-Protection Service; Current Edition, Including All Revisions.
- D. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.

#### 1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide for shop fabricated assemblies including volume control dampers and duct access doors. Include electrical characteristics and connection requirements.

#### 1.5 PROJECT RECORD DOCUMENTS

- A. Record actual locations of access doors and test holes.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect dampers from damage to operating linkages and blades.

#### 1.7 EXTRA MATERIALS

- A. See Section 01 6000 - Product Requirements, for additional provisions.
- B. Provide two of each size and type of fusible link.

## PART 2 PRODUCTS

### 2.1 AIR TURNING DEVICES

- A. Multi-blade device with radius blades attached to pivoting frame and bracket, steel construction, with push-pull operator strap.

### 2.2 BACKDRAFT DAMPERS

- A. Gravity Backdraft Dampers, Size 18 by 18 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.
- B. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

### 2.3 DUCT ACCESS DOORS

- A. Manufacturers:
  - 1. Nailor Industries Inc.
  - 2. Ruskin Company.
  - 3. Greenheck.
- B. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch thick insulation with sheet metal cover.
  - 1. Minimum size of 12 inches Square: Secure with sash locks.
  - 2. Up to 18 inches Square: Provide two hinges and two sash locks.
  - 3. Up to 24 x 48 inches: Three hinges and two compression latches .
- C. Access doors with sheet metal screw fasteners are not acceptable.

### 2.4 DUCT TEST HOLES

- A. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.
  - 1. Product: Ventlok or equal.

### 2.5 FIRE DAMPERS

- A. Manufacturers:
  - 1. Nailor Industries Inc.
  - 2. Ruskin Company.
  - 3. Pottorff.
  - 4. Greenheck.
- B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.
- C. Ceiling Dampers: Galvanized steel, 22 gage frame and 16 gage flap, two layers 0.125 inch ceramic fiber on top side and one layer on bottom side for round flaps, with locking clip.
- D. Horizontal Dampers: Galvanized steel, 22 gage frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.
- E. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations. Configure with blades out of air stream except for 1.0 inch pressure class ducts up to 12 inches in height.

- F. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

## 2.6 FLEXIBLE DUCT CONNECTIONS

- A. Fabricate in accordance with SMACNA (DCS) and as indicated.
- B. Flexible Duct Connections: Fabric crimped into metal edging strip.
  - 1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.
    - a. Net Fabric Width: Approximately 2 inches wide.

## 2.7 VOLUME CONTROL DAMPERS

- A. Manufacturers:
  - 1. Nailor Industries Inc.
  - 2. Ruskin Company.
  - 3. Greenheck.
- B. Fabricate in accordance with SMACNA (DCS) and as indicated.
- C. Single Blade Dampers: Fabricate for duct sizes up to 6 x 30 inch. Round single blade dampers shall have rolled stiffener blades with a firm, closed-cell neoprene seal at damper edges. Leakage shall not exceed 0.15 cfm per inch of blade circumference at a pressure difference of 4" w.g.
- D. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.
- E. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.
- F. Quadrants:
  - 1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
  - 2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

## 2.8 MISCELLANEOUS PRODUCTS

- A. Duct Opening Closure Film: Mold-resistant, self-adhesive film to keep debris out of ducts during construction.
  - 1. Thickness: 2 mils.
- B. High Efficiency Takeoff: Die stamped galvanized round duct takeoff with damper, operator rod gasket, flange gasket, and 2" operator standoff to allow for insulation. Sheetmetal Connectors Super HETO.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 3100 for duct construction and pressure class.
- B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.



- C. Provide duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, and elsewhere as indicated. Provide for cleaning kitchen exhaust ducts in accordance with NFPA 96. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated. Provide 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.
- D. Provide duct test holes where indicated and required for testing and balancing purposes.
- E. Provide fire dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by Authorities Having Jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.
- F. Demonstrate re-setting of fire dampers to Owner's representative.
- G. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.
- H. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.
- I. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.
- J. Provide balancing dampers in air systems where indicated.
- K. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.
- L. Install high efficiency takeoffs (HETO's) as shown on drawings on round supply duct connections to rectangular duct mains. Seal flange connections and all joints with duct sealant.

END OF SECTION 23 3300

## SECTION 23 3423 - HVAC POWER VENTILATORS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Ceiling exhaust fans.

#### 1.2 RELATED REQUIREMENTS

- A. Section 23 3300 - Air Duct Accessories: Backdraft dampers.
- B. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

#### 1.3 REFERENCE STANDARDS

- A. AMCA (DIR) - [Directory of] Products Licensed Under AMCA International Certified Ratings Program; <http://www.amca.org/certified/search/company.aspx>.
- B. AMCA 99 - Standards Handbook; 2010.
- C. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2005.
- D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2007.
- E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; 2014.
- F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2014.
- G. UL 705 - Power Ventilators; Current Edition, Including All Revisions.

#### 1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.
- C. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

#### 1.5 FIELD CONDITIONS

- A. Permanent ventilators may not be used for ventilation during construction.

#### 1.6 EXTRA MATERIALS

- A. See Section 01 6000 - Product Requirements, for additional provisions.
- B. Supply two sets of belts for each fan.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Greenheck Fan Corp..
- B. Loren Cook Company.
- C. PennBarry.

- D. Twin City Fan.

## 2.2 POWER VENTILATORS - GENERAL

- A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.
- B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.
- C. Sound Ratings: AMCA 301, tested to AMCA 300 and bearing AMCA Certified Sound Rating Seal.
- D. Fabrication: Conform to AMCA 99.
- E. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.
- F. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

## 2.3 CEILING EXHAUST FANS

- A. Manufacturers:
  - 1. Greenheck Fan Corporation: [www.greenheck.com](http://www.greenheck.com).
  - 2. PennBarry, Division of Air System Components: [www.pennbarry.com](http://www.pennbarry.com).
  - 3. Twin City Fan & Blower: [www.tcf.com/#sle](http://www.tcf.com/#sle).
- B. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.
- C. Disconnect Switch: Cord and plug in housing for thermal overload protected motor and wall mounted switch.
- D. Grille: Molded white plastic.
- E. Provide termination kit, see plans for requirements.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Hung Cabinet Fans:
  - 1. Install fans with resilient mountings and flexible electrical leads. Refer to Section 22 0548.
  - 2. Install flexible connections specified in Section 23 3300 between fan and ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.
- C. Provide sheaves required for final air balance.
- D. Install backdraft dampers on inlet to roof and wall exhausters.
- E. Provide backdraft dampers on outlet from cabinet and ceiling exhausters fans and as indicated.

END OF SECTION 23 3423

## SECTION 23 3600 - AIR TERMINAL UNITS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Variable volume terminal units.
- B. Integral heating coils.

#### 1.2 RELATED REQUIREMENTS

- A. Section 23 0548 - Vibration and Seismic Controls for HVAC Piping and Equipment.
- B. Section 23 2113 - Hydronic Piping: Connections to heating coils.
- C. Section 23 2114 - Hydronic Specialties: Connections to heating coils.
- D. Section 23 3100 - HVAC Ducts and Casings.
- E. Section 23 3300 - Air Duct Accessories.
- F. Section 23 3700 - Air Outlets and Inlets.
- G. Section 23 0913 - Instrumentation and Control Devices for HVAC: Thermostats and Actuators.

#### 1.3 REFERENCE STANDARDS

- A. ASTM A492 - Standard Specification for Stainless Steel Rope Wire; 1995 (Reapproved 2013).
- B. ASTM A603 - Standard Specification for Zinc-Coated Steel Structural Wire Rope; 1998 (Reapproved 2014).
- C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.
- D. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; Sheet Metal and Air Conditioning Contractors' National Association; 2008.
- E. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

#### 1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate air flow, static pressure, and NC designation. Include electrical characteristics and connection requirements.
- C. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant-volume regulators.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Titus

- B. Trane
- C. Tuttle & Bailey
- D. Krueger
- E. Price
- F. Nailor

## 2.2 MANUFACTURED UNITS

- A. Ceiling mounted variable air volume supply air control terminals for connection to single duct, central air systems, with electronic variable volume controls,, hot water heating coils.
- B. Identify each terminal unit with clearly marked identification label and air flow indicator. Include unit nominal air flow, maximum factory set airflow, minimum factory set air flow, and coil type.

## 2.3 SINGLE DUCT VARIABLE VOLUME UNITS

- A. Basic Assembly:
  - 1. Casings: Minimum 22 gage galvanized steel.
  - 2. Lining: Minimum 1/2 inch thick neoprene or vinyl coated fibrous glass insulation, 1.5 lb/cu ft density, meeting NFPA 90A requirements and UL 181 erosion requirements. Face lining with mylar film.
  - 3. Plenum Air Inlets: Round stub connections for duct attachment.
  - 4. Plenum Air Outlets: S slip and drive connections.
- B. Basic Unit:
  - 1. Configuration: Air volume damper assembly inside unit casing. Locate control components inside protective metal shroud.
  - 2. Volume Damper: Construct of galvanized steel with peripheral gasket and self-lubricating bearings; maximum damper leakage: 2 percent of design air flow at 1 inches rated inlet static pressure.
- C. Hot Water Heating Coil:
  - 1. Construction: 1/2 inch copper tube mechanically expanded into aluminum plate fins, leak tested under water to 200 psig pressure, factory installed.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install the inlets of air terminal units and air flow sensors a minimum of four duct diameters from elbows, transitions, and duct takeoffs.
- C. Provide ceiling access doors or locate units above easily removable ceiling components.
- D. Support units individually from structure with wire rope complying with ASTM A492 and ASTM A603 in accordance with SMACNA (SRM). See Section 23 0548.
- E. Do not support from ductwork.
- F. Connect to ductwork in accordance with Section 23 3100.

END OF SECTION 23 3600

## SECTION 23 3700 - AIR OUTLETS AND INLETS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Diffusers.
- B. Registers/grilles.
- C. Louvers.
- D. Roof hoods.

#### 1.2 RELATED REQUIREMENTS

- A. Section 09 9123 - Interior Painting: Painting of ducts visible behind outlets and inlets.

#### 1.3 REFERENCE STANDARDS

- A. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

#### 1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

### PART 2 PRODUCTS

#### 2.1 (SEE DRAWINGS FOR REGISTERS, GRILLES AND DIFFUSERS SCHEDULE)

#### 2.2 MANUFACTURERS

- A. Krueger.
- B. Price Industries.
- C. Titus.
- D. Tuttle & Bailey.
- E. Nailor.

#### 2.3 LOUVERS

- A. Type: 4 inch deep with vertical blades and with center baffle and return bend, heavy channel frame, 1/4 inch square mesh screen over exhaust and 1/4 inch square mesh screen over intake.
- B. Fabrication: 12 gage, 0.1046 inch thick extruded aluminum, welded assembly, with factory prime coat finish.
- C. Color: As indicated.

#### 2.4 ROOF HOODS

- A. Fabricate air inlet or exhaust hoods in accordance with SMACNA (DCS).

- B. Fabricate of aluminum, minimum 16 gage base and 18 gage hood; suitably reinforced; with hinged, removable hood; birdscreen with 1/2 inch square mesh for exhaust and 3/4 inch for intake
- C. Mount unit on minimum 12 inch high curb base with insulation between duct and curb.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
- C. Install diffusers to ductwork with air tight connection.
- D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.
- E. Provide balancing dampers on supply and exhaust ductwork, even if not shown on drawings, if required to accurately balance systems. Opposed blade dampers shall be provided on supply diffusers and registers and on exhaust grilles to aid balancing and draft control.
- F. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09 9123.

END OF SECTION 23 3700

## SECTION 23 5216 - CONDENSING BOILERS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Manufactured units.
- B. Boiler construction.
- C. Boiler trim.
- D. Fuel burning system.
- E. Factory installed controls.

#### 1.2 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete.
- B. Section 23 0913 - Instrumentation and Control Devices for HVAC.
- C. Section 23 2114 - Hydronic Specialties.
- D. Section 23 2123 - Hydronic Pumps.
- E. Section 23 2500 - HVAC Water Treatment.

#### 1.3 REFERENCE STANDARDS

- A. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI); current edition at [www.ahrinet.org](http://www.ahrinet.org).
- B. ANSI Z21.13 - American National Standard for Gas-Fired Low-Pressure Steam and Hot Water Boilers; 2012.
- C. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings; 2013, Including All Amendments and Errata.
- D. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; 2015.
- E. NBBI Manufacturer and Repair Directory - The National Board of Boiler and Pressure Vessel Inspectors (NBBI); current edition at [www.nationalboard.org](http://www.nationalboard.org).
- F. NFPA 54 - National Fuel Gas Code; 2015.
- G. SCAQMD 1146.1 - South Coast Air Quality Management District Rule No.1146.1; current edition.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

#### 1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittals procedures.



- B. Product Data: Provide data indicating general assembly, components, controls, safety controls, and wiring diagrams with electrical characteristics and connection requirements, and service connections.
- C. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

#### 1.7 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide a ten year warranty to include coverage for heat exchanger.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Natural Gas, Propane, or Combination Natural Gas/Propane for Indoor Applications:
  - 1. LAARS Heating Systems Company: [www.laars.com](http://www.laars.com).
  - 2. Camus.
  - 3. Aerco.

#### 2.2 MANUFACTURED UNITS

- A. Factory assembled, factory fire-tested, self-contained, readily transported unit ready for automatic operation except for connection of water, fuel, electrical, and vent services.
- B. Unit: Metal membrane wall, water or fire tube, condensing boiler on integral structural steel frame base with integral fuel burning system, firing controls, boiler trim, insulation, and removable jacket, suitable for indoor application.

#### 2.3 BOILER CONSTRUCTION

- A. Conform to the minimum requirements of ASME BPVC-IV and ANSI Z21.13 for construction of boilers.
- B. Assembly to bear the ASME "H" stamp and comply with the efficiency requirements of the latest edition of ASHRAE Std 90.1.
- C. Required Directory Listings:
  - 1. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI); current edition at [www.ahrinet.org](http://www.ahrinet.org).
  - 2. NBBI Manufacturer and Repair Directory - The National Board of Boiler and Pressure Vessel Inspectors (NBBI); current edition at [www.nationalboard.org](http://www.nationalboard.org).
- D. Heat Exchanger: Stainless steel construction that is impervious to corrosion where subject to contact with corrosive condensables.
- E. Provide adequate tappings, observation ports, removable panels, and access doors for entry, cleaning, and inspection.
- F. Insulate casing with insulation material, protected and covered by heavy-gage metal jacket.

- G. Factory apply boiler base and other components, that are subject to corrosion, with durable, acrylic, powder coated, or painted finish.

## 2.4 BOILER TRIM

- A. ASME rated pressure relief valve.
- B. Flow switch.
- C. Electronic Low Water Cut-off: Complete with test light and manual reset button to automatically prevent firing operation whenever boiler water falls below safe level.
- D. Temperature and pressure gage.
- E. Pressure Switches:
  - 1. High gas pressure.
  - 2. Low gas pressure.
  - 3. Air pressure.
- F. Manual reset high limit.
- G. Boiler Pump (where required by boiler design):
  - 1. Primary pump, factory supplied and sized for field installation to ensure minimum, continuous circulation through boiler.
  - 2. Where pump is not provided by boiler manufacturer, provide pump in accordance with boiler manufacturer's recommendations.
  - 3. Pump time delay.

## 2.5 FUEL BURNING SYSTEM

- A. Provide forced draft automatic burner, integral to boiler, designed to burn natural gas, and maintain fuel-air ratios automatically.
  - 1. Blower Design: Statically and dynamically balanced to supply combustion air; direct connected to motor.
  - 2. Forced Draft Design: Mixes combustion air and gas to achieve 95 percent combustion efficiency.
  - 3. Combustion Air Filter: Protects fuel burning system from debris.
- B. Gas Train: Plug valve, safety gas valve, gas-air ratio control valve, and pressure regulator controls air and gas mixture.
- C. Emission of Oxides of Nitrogen Requirements: Comply with SCAQMD 1146.1 for natural gas fired system, as applicable.
- D. Intakes: Combustion air intake capable of accepting free mechanical room air or direct outside air through a sealed intake pipe

## 2.6 FACTORY INSTALLED CONTROLS

- A. Option for internal or external (0-10) VDC control.
- B. Temperature Controls:
  - 1. Automatic reset type to control fuel burning system on-off and firing rate to maintain temperature.
  - 2. Manual reset type to control fuel burning system to prevent boiler water temperature from exceeding safe system water temperature.
  - 3. Low-fire start time delay relay.
- C. Electronic PI setpoint/modulation control system.

- D. Microprocessor-based, fuel/air mixing controls.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install boiler and provide connection of natural gas service in accordance with requirements of NFPA 54 and applicable codes.
- C. Install boiler on concrete housekeeping base, sized minimum of 4 inches larger than boiler base in accordance with Section 03 3000.
- D. Coordinate factory installed controls with Section 23 0913.
- E. Coordinate provisions for water treatment in accordance with Section 23 2500.
- F. Pipe relief valves to nearest floor drain.
- G. Pipe cooled condensate produced by the combustion process from the boiler condensate connection and/or flue stack with suitable piping material to neutralizer prior to discharging into nearest floor drain.
- H. Install primary boiler pump in accordance with Section 23 2123.
- I. Provide piping connection and accessories in accordance with Section 23 2114.

END OF SECTION 23 5216

## SECTION 23 7415 - VAV MODULAR CENTRAL-STATION ROOFTOP AIR-HANDLING UNITS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Rooftop air handling units: RTU-1

#### 1.2 RELATED REQUIREMENTS

- A. Section 22 0513 - Common Motor Requirements for Plumbing Equipment.
- B. Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.
- C. Section 22 0719 - Plumbing Piping Insulation.
- D. Section 23 0719 - HVAC Piping Insulation.
- E. Section 23 3300 - Air Duct Accessories: Flexible duct connections.
- F. Section 26 2717 - Equipment Wiring: Electrical characteristics and wiring connections.

#### 1.3 REFERENCE STANDARDS

- A. AHRI 430 - Standard for Central-Station Air-Handling Units; Air-Conditioning, Heating, and Refrigeration Institute; 2009.

#### 1.4 SUBMITTALS

- A. See Administrative Requirements, for submittal procedures.
- B. Product Data:
  - 1. Published Literature: Indicate dimensions, weights, capacities, ratings, gages and finishes of materials, and electrical characteristics and connection requirements.
  - 2. Fans: Performance and fan curves with specified operating point clearly plotted, power, RPM.
  - 3. Sound Power Level Data: Fan outlet and casing radiation at rated capacity.
  - 4. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.
- C. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.
- D. Maintenance Data: Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.
- E. Maintenance Materials: Furnish the following for Owners use in maintenance of project.
  - 1. Extra filter: one set for each unit

#### 1.5 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.

- B. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.
- C. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Valent.
- B. The Trane Company.
- C. Daikin Applied.

### 2.2 GENERAL DESCRIPTION

- A. Configuration: Fabricate with fan and coil section plus accessories, including:
  - 1. Cooling coil section.
  - 2. Heating coil.
  - 3. Filter section.
- B. Fabrication: Conform to AMCA 99 and ARI 430.
- C. Overall unit shall have 12 month warranty from substantial completion, and 18 month warranty from unit ship date.

### 2.3 FRAMEWORK AND CASING

- A. Base rails shall be constructed of a minimum of 10 gage galvanized steel with 1" foam-injected double-wall floor.
- B. Base shall have a minimum 4" overhang over the top of a roof curb to prevent water infiltration.
- C. All floor seams shall have a raised rib joint.
- D. There shall be no penetrations through the floor of the unit within the perimeter of the curb except for duct openings and utility chases.
- E. Penetrations through the floor shall have a ½" raised rib around each opening.
- F. Casing shall be constructed with minimum 2-inch, insulated, double-wall panels.
- G. Individual panels shall be constructed so that they are thermally broken (there shall be no metal-to-metal contact between the interior and exterior sheet metal of each panel).
- H. Interior side of panel shall be 22 gage galvanized steel.
- I. Exterior side of panel shall be 22 gage painted steel rated for 1000 hours in accordance with ASTM B117 and ASTM D1654.
  - 1. Insulation shall be 1.5 lb./ft<sup>3</sup> foam insulation with an R-value of 4.1.
    - a. Insulation water absorption must be no more than 0.038 lb/ft per ASTM D 2842 and show "no growth" per ASTM G21 biocide testing.
    - b. No insulation shall be exposed to the air stream.
    - c. Fiberglass insulation is not acceptable due to possibility of sloughing and moisture retention.

J. Access doors:

1. Access doors shall be provided for access to all components requiring regular maintenance or inspection.
2. Access doors shall have a minimum of two quarter-turn compression latches with adjustable catches.
3. Access door construction shall be identical to unit casing.
4. Interior side of access doors shall be 22 gage galvanized steel.
5. Exterior side of panel shall be 22 gage painted steel rated for 1000 hours in accordance with ASTM B117 and ASTM D1654.
6. Access doors shall be sealed with a full-perimeter gasket constructed of Mylar-encased low-density foam.
7. Insulation
  - a. Insulation shall be 1.5 lb/ft<sup>3</sup> foam insulation with a minimum R-value of 4.1.
  - b. Insulation water absorption must be no more than 0.038 lb/ft per ASTM D 2842 and show "no growth" per ASTM G21 biocide testing.
  - c. No insulation shall be exposed to the air stream.
  - d. Fiberglass insulation is not acceptable due to possibility of sloughing and moisture retention.

K. Weather hood with bird screen shall be provided on outside air inlet.

L. Roof shall be pitched with a minimum ½" roof overhang around the perimeter of the unit.

2.4 AIR COOLED CONDENSING SECTION

- A. Unit shall be provided with factory piped, charged, and tested packaged air-cooled direct expansion refrigeration system.
- B. Refrigeration systems shall consist of scroll compressors and one of the compressors shall be inverter controlled to match system load. The inverter compressor shall have a separate oil pump and low oil safety protection.
- C. Refrigeration system shall include microprocessor-based head pressure control logic to maintain refrigerant pressures by actively modulating condenser airflow (Active Head Pressure Control), fan motors shall be ECM type for proportional control.
- D. Fans shall be low noise blade design with dynamic profile for low tip speed.
- E. Thermal expansion valves
  1. Refrigeration system shall be provided with thermal expansion valve (TXV) incorporating adjustable superheat.
- F. Provide condenser coils with galvanized casing, seamless copper tubes, and aluminum fins.
  1. Coil casing shall be constructed of 16 gage galvanized steel.
  2. Coil tubes shall be constructed of 3/8" diameter, 0.016" thick seamless copper tubing.
  3. Coil fins shall be constructed of 0.0060" thick aluminum fins.
  4. Condensing fans - Standard
    - a. Condensing section shall be equipped with 1140 rpm direct-drive condensing fans.
    - b. Condensing fan assembly shall be statically and dynamically balanced in accordance with AMCA Standard 204-05.
    - c. Condensing fan assembly shall consist of aluminum-bladed propeller fan wheel, formed-channel base, formed inlet venturi, and coated steel basket guard on the discharge.

- d. Condensing fans shall enable and stage based on fixed pressure levels in the condensing section.

## 2.5 COMPRESSOR

- A. Compressors shall be hermetic scroll type and include the following items:
  - 1. Suction and discharge service valves.
  - 2. Reverse rotation protection.
  - 3. Oil level adjustment.
  - 4. Oil filter.
  - 5. Rotary dirt trap.
  - 6. Short cycling control.
  - 7. High and low pressure limits.
  - 8. Crankcase heaters.
- B. Compressors shall be installed in an isolated compartment separate from supply airflow, return airflow, microprocessor controller, non-fused disconnect, compressor relays, fan motor VFD, and all other electrical components inside the unit.
- C. Compressors shall be installed using manufacturer's recommended rubber vibration isolators.
- D. Lead refrigeration circuit shall utilize Digital Scroll or variable speed scroll compressor capable of 10:1 turndown.
- E. Provide 5 year warranty on compressor from time of substantial completion, and 5 years, 6 months from equipment ship date.

## 2.6 EVAPORATOR COIL

- A. Coil shall be rated in accordance to ARI standards and pressure tested for 250 psi working pressure.
- B. Coil shall be a minimum of 3 rows deep.
- C. Refrigeration systems with more than one circuit shall have interlaced evaporator coils.
- D. Coil casing shall be constructed of 16 gage galvanized steel casing.
- E. Coil tubes shall be constructed of 1/2" diameter, 0.016" thick seamless copper tubing.
- F. Coil fins shall be constructed of 0.0060" thick aluminum.
- G. Drain pan
  - 1. Drain pan shall be constructed of a minimum of 18 gage 201 stainless steel.
  - 2. Drain pan shall be double-sloped to ensure condensate removal from unit.

## 2.7 GAS FIRED HEAT EXCHANGER

- A. Tubular design with in-shot gas burners, installed down stream of supply air fan.
- B. 12:1 modulating operation
- C. Stainless steel construction
- D. Induced draft fan to maintain negative pressure in the heat exchanger.
- E. Provide air flow safety switch on induced fan and high temperature limit switch.

## 2.8 SUPPLY AND RELIEF FAN

### A. Blowers

1. Fan assemblies shall be direct-drive without the use of belts or adjustable sheaves.
2. Manufacturer shall provide a variable frequency drive for each fan section.
3. Variable frequency drive shall be mounted, wired, and programmed by the manufacturer.
4. Variable frequency drive shall be located in an enclosed compartment outside of the supply or exhaust air stream.
5. Fan wheel shall be tested in accordance to AMCA 210.

### B. Motors

1. Fan motor shall be VFD rated, ODP type, EPACT compliant.
2. Fan motor shall be of premium efficiency (PE).

## 2.9 OUTDOOR/RETURN AIR SECTION

### A. Economizer

1. Include outdoor, return and exhaust air dampers
2. 100% cooling capacity
3. Factory installed outdoor air hood with the same finish as the unit

## 2.10 DAMPERS

### A. Motorized dampers

1. Frame shall be constructed of a 16 gage galvanized steel hat-channel.
2. Blades shall be constructed of 16 gage galvanized steel.
3. Blades shall be symmetrical relative to its axle pivot point.
4. Axle bearings shall be synthetic sleeve-type and rotate inside extruded holes in the damper frame.
5. Blade seals shall be extruded vinyl permanently bonded to the appropriate blade edges.
6. Frame shall include flexible stainless steel compression-type jamb seals.
7. Modulating spring-return actuators shall be provided by the factory, installed on the damper, and wired to the control center.
8. Damper leakage shall be no more than 3 cfm/sq. ft. at 1 inch w.g. static pressure.

- B. Blades shall operate without clatter or binding and damper linkage is located outside of the airstream.

## 2.11 FILTERS

- A. Filter section with 2" MERV 8 prefilter and 4" MERV 13 final filter
- B. Provide spare set of filters.

## 2.12 LOUVERS

- A. Outside air louvers shall be of a storm proof design and provided with a ½" x ½" galvanized bird screen. A fully insulated divider deck shall be provided to separate outside air from return air.

## 2.13 ELECTRICAL

- A. Units shall be factory wired with a single point power connection.
- B. Units shall be wired according to NEC and listed per ETL.



- C. ETL listing shall cover all components of the ventilator and not be limited to the control panel.
- D. All major electrical components shall be UL listed.
- E. Unit shall be constructed with an integral control center isolated from supply airflow, exhaust airflow, compressors, and heating elements.
- F. The following items shall be provided and wired within the control center by the factory:
  - 1. 65,000 A SCCR Fused disconnect.
  - 2. Sub-circuit fusing.
  - 3. Low voltage transformers.
  - 4. Control circuit fusing.
  - 5. Terminal block.
  - 6. Fan motor variable frequency drives.
- G. Electrical panel must house all high voltage components such as terminal blocks, variable frequency drives, and fuse blocks.

#### 2.14 TEMPERATURE CONTROLS

- A. Units shall include factory supplied, mounted, wired, and tested stand-alone microprocessor controls.
- B. Microprocessor controller shall be factory-programmed for discharge air control and use an internal 7-day time clock.
- C. Microprocessor controller shall be mounted in a weather-proof enclosure and accessible without exposing the operator to high voltage wiring or having to turn off or circumvent the main disconnect.
- D. Microprocessor controller shall include local liquid crystal display (LCD) for user interface.
- E. The following sensors shall be factory supplied, mounted, and wired inside the unit:
  - 1. Outdoor air humidity sensor.
  - 2. Outdoor air temperature sensor.
  - 3. Evaporator coil leaving air temperature sensor.
  - 4. Supply air filter pressure monitoring.
- F. The following devices shall be factory supplied but ship loose and require field installation and wiring:
  - 1. Return Air Duct mounted room air temperature sensor with manual adjuster.
  - 2. Return Air Duct mounted room air humidity sensor.
  - 3. Return Air Duct mounted CO2 sensor.
  - 4. Duct static pressure sensor.
  - 5. Smoke detectors (by Electrical Contractor).
- G. The unit shall be provided with a DDC unit control panel with a BACNET interface. All control logic shall be programmed and points listed below shall be available to the building DDC system. The control contractor shall connect to the unit interface via a Ethernet connection.
  - 1. The following points shall be made available via BACNET to the building DDC system:
    - a. Supply Air Discharge Temperature
    - b. Return Air Temperature and Humidity
    - c. Outdoor air temperature
    - d. Outdoor air enthalpy

- e. Mixed Air Temperature
- f. Filter Static Pressure
- g. Economizer Control Signal
- h. Damper Position Indication
- i. Supply Fan Status
- j. Manual Lockout
- k. Dirty filter indication
- l. Phase Monitor Trip
- m. Carbon Dioxide Level
- n. General Alarm
- o. Supply Fan VFD Output
- p. Supply Discharge Pressure setting
- q. Active alarms with time and date
- r. Previous alarms with time and date

H. Unit Controls

- 1. All unit controls shall be factory provided, and wired. All logic shall be programmed at the factory. All control power connections/transformers shall be factory provided.
  - a. The control contractor under section 23 0900 shall start/stop the unit as well as provide occupied/unoccupied scheduling of the unit. Upon start up, the unit controls shall modulate the return air and fresh air dampers to the correct positions. The supply and return fan shall run continuously.
  - b. The building DDC system shall provide the supply air discharge temperature setpoint to the unit. If heating is required, the roof top unit shall modulate the valve for the heating coil, to maintain setpoint. If cooling is required to maintain discharge temperature, the unit controls shall modulate the compressor/refrigerant cycle to provide cooling.
  - c. The unit shall modulate the fresh air and relief air dampers. The unit controls shall also provide a enthalpy based economizer cycle, and shall modulate the return/relief dampers if the outdoor air is equal to 55 degrees F, and enthalpy is favorable.
  - d. The unit shall be provided with a carbon dioxide sensor in the return air stream. The fresh air damper shall be modulated to a minimum position if the space CO2 levels are at a low value. The minimum cfm value is listed on the RTU schedule, and the position shall be determined with assistance from the balancer. All controls shall be by the unit controls.
  - e. A discharge pressure sensor shall be provided with the unit, and be installed in the supply air discharge plenum. The supply blower VFD shall be modulated by unit controls to maintain the discharge pressure. The setting shall be made in conjunction with the balancer. The return fan VFD shall track the supply.
  - f. All individual room control shall be done by the building BMS

PART 3 EXECUTION

3.1 INSTALLATION

- A. Unit shall be run tested prior to shipment from the factory.
- B. Factory run test report shall be provided at the request of the engineer, contractor, or owner.

C. Testing Procedures:

1. All motorized dampers shall be cycled one full stroke while installed in the unit using the factory-provided motorized actuators.
2. Supply fan
  - a. Visually inspect ramp-up, ramp-down, and rotation direction of fan when enabled.
  - b. Verify fan pressure proving switch operation.
  - c. Measure and record current draw through supply fan motor(s).
3. Condensing fans
  - a. Ensure fans rotate freely without obstruction.
  - b. Energize fans and ensure proper rotation.
  - c. Measure and record the amount of current draw through each condensing fan.
4. Refrigeration system
  - a. Measure and record subcooling and superheat on circuit A with hot-gas reheat valve closed (0%) after 15 minutes of steady-state operation.
  - b. Measure and record subcooling and superheat on circuit A with hot-gas reheat valve open (100%) after 15 minutes of steady-state operation.
  - c. Measure and record subcooling and superheat on circuit B after 15 minutes of steady-state operation.

D. Test report shall be included with unit and available from the factory upon request.

E. Install in accordance with manufacturer's instructions.

F. Make connections to coils with unions or flanges.

END OF SECTION 23 7415

## SECTION 23 8127 - SMALL SPLIT-SYSTEM HEATING AND COOLING

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Air-source heat pumps.
- B. Forced air furnaces.
- C. Indoor ductless fan & coil units.

#### 1.2 RELATED REQUIREMENTS

- A. Section 22 1005 - Plumbing Piping: Includes indoor coil condensate drain and natural gas piping.
- B. Section 23 3100 - HVAC Ducts and Casings.
- C. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections and installation and wiring of thermostats and other controls components.

#### 1.3 REFERENCE STANDARDS

- A. AHRI 210/240 - Standard for Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2008.
- B. AHRI 520 - Performance Rating of Positive Displacement Condensing Units; 2004.
- C. ASHRAE Std 23.1 - Methods of Testing for Rating Positive Displacement Refrigerant Compressors and Condensing Units; 2010.
- D. NEMA MG 1 - Motors and Generators; 2014.
- E. NFPA 54 - National Fuel Gas Code; 2015.
- F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.
- G. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2015.
- H. NFPA 211 - Guide for Smoke and Heat Venting; 2013, Including All Amendments.
- I. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.

#### 1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.
- C. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.
- D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

- E. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Filters: One for each unit.

## 1.5 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturers warranty for compressors.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Trane Inc.
- B. Daikin.
- C. York International Corporation / Johnson Controls: [www.york.com](http://www.york.com).
- D. Lennox.

### 2.2 SYSTEM DESIGN

- A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.
  - 1. Heating and Cooling: Air-source electric heat pump with evaporator coil in ducted blower unit.
  - 2. Auxiliary Heating: Natural gas fired.
  - 3. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.
- B. Performance Requirements: See Drawings for additional requirements.

### 2.3 INDOOR UNITS FOR DUCTED SYSTEMS

- A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating and cooling element(s), controls, and accessories; wired for single power connection with control transformer.
  - 1. Air Flow Configuration: Upflow.
  - 2. Cabinet: Steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.
  - 3. Low Temperature Pipe, Tubing, and Heat Exchangers: Insulated with elastomeric insulation having flame spread index less than 25 and smoke developed index of less than 50, when tested in accordance with ASTM E84; and UL 94 rated.
- B. Supply Fan: Centrifugal type rubber mounted with direct or belt drive with adjustable variable pitch motor pulley.
  - 1. Motor: NEMA MG 1; 1750 rpm single speed, permanently lubricated, hinge mounted.
  - 2. Motor Electrical Characteristics:
- C. Air Filters: 1 inch thick urethane, washable type arranged for easy replacement.
- D. Refrigeration Circuits: Copper refrigerant piping, liquid line service valve, suction line service valve, full charge of compressor oil, holding charge of refrigerant; thermostatic

expansion valves for refrigerant metering, and solenoid activated refrigerant reversing valves energized only during the cooling mode and designed to fail in the heating position.

- E. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
  - 1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
  - 2. Manufacturers: System manufacturer.
- F. Compressor: AHRI 520; hermetic scroll, 3600 rpm, resiliently mounted integral with condenser, with positive lubrication, crankcase heater, high pressure control, motor overload protection, service valves and drier. Provide time delay control to prevent short cycling and rapid speed changes.

#### 2.4 INDOOR UNITS FOR DUCTLESS SYSTEMS

- A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, evaporator coil, and controls; wired for single power connection with control transformer.
- B. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
  - 1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
  - 2. Manufacturer: System manufacturer.
- C. Remote Actuators:

#### 2.5 OUTDOOR UNITS

- A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.
  - 1. Refrigerant: R-410A.
  - 2. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23.1 and UL 207.
- B. Air Cooled Condenser: Aluminum fin and copper tube coil, AHRI 520 with direct drive axial propeller fan resiliently mounted, galvanized fan guard.
- C. Accessories: Filter drier, high pressure switch (manual reset), low pressure switch (automatic reset), service valves and gage ports, thermometer well (in liquid line).
  - 1. Provide thermostatic expansion valves.
- D. Operating Controls:
  - 1. Control by room thermostat to maintain room temperature setting.

#### 2.6 GAS FURNACE COMPONENTS

- A. Heat Exchanger: Aluminized steel ceramic coated clamshell type welded construction.
- B. Burner: Atmospheric type with adjustable combustion air supply.
  - 1. Gas valve provides 100 percent safety gas shut-off; 24 volt combining pressure regulation, safety pilot, manual set (On-Off), pilot filtration, automatic electric valve.
  - 2. Automatic vent damper with synchronous spring return damper motor.
  - 3. Non-corrosive combustion air blower with permanently lubricated motor.
- C. Burner Safety Controls:

1. Thermocouple Sensor: Prevents opening of gas valve until pilot flame is proven and stops gas flow on ignition failure.
  2. Flame Rollout Switch: Installed on burner box and prevents operation.
  3. Vent Safety Shutoff Sensor: Temperature sensor installed on draft hood and prevents operation, manual reset.
  4. Limit Control: Fixed stop at maximum permissible setting, de-energizes burner on excessive bonnet temperature, automatic resets.
- D. Operating Controls:
1. Cycle burner by room thermostat to maintain room temperature setting.
  2. Supply fan energized from bonnet temperature independent of burner controls, with adjustable timed off delay and fixed timed on delay, with manual switch for continuous fan operation.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.
- B. Verify that proper power supply is available and in correct location.
- C. Verify that proper fuel supply is available for connection.

#### 3.2 INSTALLATION

- A. Install in accordance with NFPA 90A and NFPA 90B.
- B. Install gas fired furnaces in accordance with NFPA 54.
- C. Provide vent connections in accordance with NFPA 211.
- D. Pipe drain from evaporator coil connection to nearest floor drain.

END OF SECTION 23 8127

## SECTION 26 0101 - COMMON ELECTRICAL WORK

### PART 1 GENERAL

#### 1.1 SCOPE

- A. This Section shall apply to all Contractors and Subcontractors that are responsible for Division 26, 27, and 28.
- B. The work covered by this Section of the Specifications consists of furnishing all labor and materials (unless otherwise specified) and in performing all operations necessary for the installation of the complete electronic and electrical system as required by terms and conditions of the Contract. The work shall also include the completion of such details of electrical work not mentioned or shown which are necessary for the successful operation of all electrical and electronic systems described on the drawings or required by these Specifications.
- C. The work in this Contract involves the installation of new work as well as work on the Site and may include demolition and renovation work. It shall be this Contractor's responsibility to visit the site so that he may ascertain all existing conditions which may affect the work under his Contract. No additional compensation will be granted for additional work required by this Contractor for his failure to visit the jobsite and determine existing conditions. This Contractor shall provide all labor and materials required to complete the work described in the Plans and Specifications and as may be required for a ready to operate installation.
- D. Generally the removal and repairing of existing floors, walls, ceilings, etc., in the remodeled areas where required for the installation of conduit, lights, panels, etc., shall be provided by the General Contractor under the direction of this Contractor. Holes required through floors, walls, and roof of the building shall be provided by this Contractor. If specifically shown to be done by this Contractor, this Contractor shall include in his Contract price the removal and replacement of general construction materials as required.

#### 1.2 DEFINITIONS

- A. Where the terms "provide" or "shall be" are used in the Specifications or Plans, they shall be taken to mean, "the Electrical Contractor shall furnish and install".
- B. Where the word "electrical" is used in these Specifications and Plans it shall mean both "electrical and electronic" as the case may be.
- C. The term "Contractor" used throughout Division 26, 27, and 28 of these Specifications shall be understood to mean the Electrical Contractor.
- D. The term "as shown on the drawings" has been omitted from this Specification, but it shall be understood that the drawings and Specifications complement one another and items specified shall also meet the criteria set forth on the drawings.

#### 1.3 DRAWINGS

- A. The drawings which constitute a part of this Contract indicate the general arrangement of circuits and outlets, locations of switches, panelboards, and other work. The Drawings and Specifications are complimentary each to the other, and what is called for by one shall be binding as if called for by both. Data presented on these drawings are as accurate as planning can determine, but accuracy is not guaranteed and field



verification of all dimensions, locations, levels, etc., to suit field conditions is required. Review all Architectural, Structural, and Mechanical Plans and adjust all work to conform to all conditions shown therein. The Architectural Drawings shall take precedence over all other drawings as to dimensions.

#### 1.4 CONFLICTS

- A. Any conflict noted between (1) the Drawings; (2) Specifications; or (3) Drawings and Specifications; or (4) between Plans and Codes or Ordinances or (5) between the Plans or Specifications and Manufacturer's installation recommendations shall be immediately brought to the attention of the Architect for clarification. If conflicts are discovered prior to bidding and there is not sufficient time to obtain a clarification from the Architect prior to bidding, the Contractor shall bid the larger quantity or better quality of work. All conflicts shall be brought to the attention of the Architect when discovered and before installation.
- B. Contractor shall be responsible to field measure and confirm mounting heights and locations of electrical equipment with respect to counters, radiation, etc. Do not scale distances off the Electrical Plans. Use actual building dimensions from the Architectural Drawings.

#### 1.5 WORK IN EXISTING BUILDINGS

- A. All work in existing buildings, indicated on the drawings or specified herein, shall be executed with a minimum amount of interference with the normal activities of the occupants of the building. No services or utilities shall be interrupted without previous scheduling time of the same with the Owner and receipt of his approval. Changing of the electrical system, telephone system, and other major events shall be arranged and be agreeable with the Owner to length and time of downtime. All work shall be scheduled in advance with the Owner and shall not proceed without the Owner's written approval.
- B. The Owner shall be notified before starting to weld or cut. Fire extinguishers shall be immediately accessible when welding or cutting with an open flame or arc. Welding or cutting with an open flame or arc must be stopped in a timely fashion before leaving premises.
- C. Noisy operations such as those involving use of air hammers, etc., in demolition, or cutting of openings shall be scheduled with the Owner.
- D. Typically, the Owner will continue to occupy the building and carry on normal activity. Each Contractor shall protect the occupied areas from dust, smoke, etc., by a method approved by the Owner/Architect.

#### 1.6 EXAMINATION OF SITE

- A. Prior to submitting a bid, this Contractor shall visit the site of the job and ascertain all conditions affecting the proposed electrical installation and make provisions as to the cost thereof. No additional compensation will be granted for additional work required by this Contractor for failure to visit jobsite and determine existing conditions. The Contractor shall verify location and size of existing systems that are to be connected to, routed around, or extended from.
- B. The Contractor shall verify with the City and Utility Companies, and Owner, etc., the location of any existing overhead or buried utilities on or near the site. The Contractor shall verify requirements for connecting into existing utilities with the City and Utility Company, and Owner and connect into as required. Failure to determine existing

conditions or the nature of new connections will not be considered a basis for the granting of additional compensation.

#### 1.7 PRIOR APPROVAL

- A. The Contractor's attention is directed to the requirement of "prior approval" for materials to be supplied in this project if they are not specifically designated as a specified manufacturer or approved equal.
- B. Prior approval requires that literature be submitted to the Architect a minimum of ten (10) days prior to the bidding date. This submitted material shall be informative enough to allow the Engineer to give approval. This approval is a tentative approval and does not imply anything but approval to bid.

#### 1.8 SHOP DRAWINGS

- A. The Contractor shall submit Shop Drawings of all items of equipment listed in this Specification and on the Drawings. Shop Drawings shall also include light fixtures, wiring devices, disconnect switches, panels, etc. provided under this Contract. Shop Drawings shall be submitted whether they are the exact specified manufacturer's numbers or a different manufacturer and number.
- B. Where an item or portion of the equipment differs from the Specifications, this fact shall be called to the attention of the Engineer to permit evaluation of the alternate item. Approval of the equipment will be only to the degree that the information is shown on the submittal and it shall not be construed to mean approval of items, materials, or details not shown but which are required by the Specification or Plans.
- C. Shop Drawings will be reviewed to the extent of the information shown on the submittal. Review of an item of equipment cannot be construed to mean approval for components of that item of equipment for which no information is furnished to show compliance with Plans and Specifications. Where additional work, controls, wiring, components, etc., are required to install and or make an operable system, or such controls, wiring components etc., are required by the Plans and Specifications, the approval of these drawings shall not relieve the Contractor from furnishing all items and the quantity required.
- D. Shop Drawings shall indicate manufacturer's delivery time for the item after receipt of approval by the Engineer.

#### 1.9 USE OF OTHER THAN SPECIFIED EQUIPMENT

- A. All equipment shown on the drawing shall be specified equipment. If the Contractor uses different approved equipment than what was specified, all additional work or components required to make an operable system shall be made without additional cost to the Owner. The Contractor shall be held responsible for selecting different approved equipment so that equipment will fit into the available space provided for the specified equipment.

#### 1.10 PERMITS AND LICENSES

- A. Obtain and pay all permits and licenses required and furnish the Architect for the Owner a certificate of final inspection and approval from the Local Authority having jurisdiction over this electrical installation.

#### 1.11 WARRANTY

- A. The entire electrical system installed under this Contract shall be left in proper working order. Replace, without additional charge, any work or material (except materials not furnished by the Electrical Contractor) which develops defects from ordinary wear and tear within one (1) year from the date of acceptance, or provide extended warranty, as specified. All new material and equipment shall be warranted against defects in composition, design, or workmanship. Lamps shall be warranted for their published life. Warranty certificates shall be furnished on special equipment.

#### 1.12 PROGRESS OF WORK AND DOWNTIME

- A. Order the progress of the electrical work so as to conform to the progress of the work as scheduled in the Specifications and complete the entire installation as soon as the condition of the building will permit. Any cost resulting from defective or ill-timed work performed under this Section shall be borne by this Contractor.
- B. As much of this building may be occupied when construction is ongoing it will be of prime importance to coordinate downtime of electrical systems with the Owner. Changing of the electrical entrance and other major events shall be arranged and be agreeable with the Owner to length and time of downtime.

#### 1.13 COORDINATION

- A. The Contractor shall confirm dimensions noted and locations of General and Mechanical Contractor's equipment as well as equipment to be furnished by the Owner. Verify all equipment and motor sizes, voltage and connection requirements for equipment furnished by others and wired under this Contract before roughing-in, and provide proper branch circuits and connections as recommended by equipment manufacturers. Coordinate with the other contractors to avoid interference with ductwork, structural members, grilles, cabinetwork, etc. Motors shall not be connected to until verification has been made that motor running protection exists.
- B. Where the drawings indicate fixtures and equipment which are to be furnished by others (or Owner) and which require connections to the electrical systems, the Electrical Contractor shall furnish and install all rough-in of conduit, boxes, conductors, disconnect switches, plugs with pigtails, receptacles etc., which are required for the final connections. Rough-in locations and required connections shall be determined from the equipment itself or from the equipment manufacturer's shop drawings. Final connections to the equipment shall be made by this Contractor.

#### 1.14 CUTTING AND PATCHING

- A. Each Contractor shall be responsible for all cutting and patching required for his work. Carefully lay out all work in advance and where cutting, channeling, chasing, or drilling of building surfaces is necessary for the proper installation of electrical equipment, carefully perform this work in a manner approved by the Architect. Patching shall be done in a neat workmanlike manner by craftsmen skilled in the trade involved and shall be prepared to receive paint. Damaged surfaces shall be repaired at no cost to the Owner. Concrete walls shall be cut only with rotary type drilling tools. Openings through floors and walls may be drilled up to 1" but shall be cored over 1". Electrical equipment shall not be cut with torches, and shall be joined only by bolting (i.e., do not weld wireways to panels, etc.).

#### 1.15 INDUSTRY STANDARDS AND CODES

- A. The complete installation shall comply with the applicable Local and State wiring ordinances, with the regulations of the latest edition of the National Electrical Code of the National Fire Protection Association (supplements and official interpretations included) and with the requirements of the Power, Television, and Telephone Companies furnishing service to this installation. The drawings and specifications take precedence when they are more stringent than codes, ordinances, or statutes in effect, and vice versa. In addition, the following latest industry standards, specifications, and codes are minimum requirements.
  - 1. The National Electrical Manufacturer's Association Standards
  - 2. The National Electrical Safety Code
  - 3. Underwriter's Laboratories, Inc., Standards
  - 4. International Building Code
  - 5. International Fire Code
  - 6. International Energy Conservation Code
  - 7. State Health Department
  - 8. State Building Codes
  - 9. State Fire Codes
  - 10. State Energy Codes
  - 11. City Building Codes
  - 12. City Electrical Codes
  - 13. State Energy Code
- B. All work shall be in accordance with State and Local Codes and requirements of Local Utilities. Where the applicable Building Codes and the drawings or specifications do not agree, the code shall take precedence, but only in cases where what is shown on the drawings or required by the specifications violates the code. Where there is a Code or Utility Company requirement and drawing or specification discrepancy the Code shall have precedence only when it is more stringent than the item specified or shown on the drawings. Items that are allowable by the Local Building Codes, which are less stringent than that required by the specifications or the drawings the less stringent work, shall not be substituted.

#### 1.16 RESPONSIBILITY OF THE CONTRACTOR

- A. The Contractor and his journeymen shall have Electrical Licenses, as required by the City and State in which work is being performed, and shall provide journeymen to work as superintendents and/or foremen on the project. All workmen shall be skilled in their trade or working under someone who is skilled in the trade and responsible for the work involved.
- B. The Contractor shall be totally responsible for his portion of the work from the date of his Contract until final acceptance of the building by the Owner, and must repair all damage sustained without cost to the Owner regardless of cause. The Contractor shall use proper care and diligence in bracing and securing all parts of the work against the elements and shall, in all cases, judge as to the amount of protection required. Proper storage of material shall be maintained at all times.

#### 1.17 TEMPORARY POWER AND LIGHTING

- A. The Electrical Contractor shall provide electrical wiring and light fixtures for temporary power, heating, and lighting in construction areas.

1.18 FIRE AND SMOKE STOPPAGE

- A. It shall be the responsibility of this Contractor to maintain the fire and smoke integrity of all walls, ceilings, floors etc., through which his work passes through or into. Fire and smoke barriers shall be provided in and around as required by Codes.
- B. Where holes are required to be patched, or conduit, piping, ducts, etc., are required to be patched around, it shall be filled with a material that is UL Classified Standard 1479 for this use and Factory Mutual System approved.

1.19 ACCESS TO EQUIPMENT

- A. All control devices, specialties, pull boxes, disconnect switches, and similar equipment shall be so located as to provide for easy access for operation, repair and maintenance. Access shall conform to Local Electric Codes. Access doors shall be provided if devices are concealed.

1.20 TESTS

- A. At the completion of his work, the Contractor shall perform the following tests in the presence of the Architect.
  - 1. Test for short circuits and grounds.
  - 2. Test to prove correct operation of all equipment, including lighting control systems.
  - 3. Check for balance of load on phases, and connect load to balance as closely as possible. Should the Power Company disclose any unfavorable conditions or reactions on the service, the Contractor shall make changes as may be suggested to properly balance the load.

1.21 CLEAN-UP

- A. The Contractor shall remove all rubbish and debris resulting from his work daily and shall leave equipment that he installed clean and ready for operation.

1.22 RECORD DRAWINGS

- A. Maintain a clean, undamaged set of whiteprints of Contract Drawings. Mark the set to show the actual installation where the installation varies from the work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
  - 1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the work.
  - 2. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.
  - 3. Note related Change Order numbers where applicable.
  - 4. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dated and other identification on the cover of each set.
  - 5. Turn Record Drawings over to the Owner with the Operation and Maintenance Manuals.

END OF SECTION 26 0101

## SECTION 26 0505 - SELECTIVE DEMOLITION FOR ELECTRICAL

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Electrical demolition.

### PART 2 PRODUCTS

#### 2.1 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work: As specified in individual sections.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that abandoned wiring and equipment serve only abandoned facilities.
- B. Report discrepancies to Engineer before disturbing existing installation.
- C. Beginning of demolition means installer accepts existing conditions.

#### 3.2 PREPARATION

- A. Disconnect electrical systems in walls, floors, and ceilings to be removed.
- B. Coordinate utility service outages with utility company.
- C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
- D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.

#### 3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:
  - 1. PCB-containing electrical equipment, including transformers, capacitors, and switches.
  - 2. PCB- and DEHP-containing lighting ballasts.
  - 3. Mercury-containing lamps and tubes, including fluorescent lamps, high intensity discharge (HID), arc lamps, ultra-violet, high pressure sodium, mercury vapor, ignitron tubes, neon, and incandescent.
- B. Remove, relocate, and extend existing installations to accommodate new construction.
- C. Remove abandoned wiring to source of supply.
- D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

- E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.
- F. Repair adjacent construction and finishes damaged during demolition and extension work.
- G. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

3.4 CLEANING AND REPAIR

- A. Clean and repair existing materials and equipment that remain or that are to be reused.

END OF SECTION 26 0505

## SECTION 26 0519 - CONDUCTORS AND CABLES

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Single conductor building wire.
- B. Wiring connectors.
- C. Electrical tape.
- D. Heat shrink tubing.
- E. Oxide inhibiting compound.
- F. Wire pulling lubricant.
- G. Cable ties.

#### 1.2 RELATED REQUIREMENTS

- A. Section 07 8400 - Firestopping.
- B. Section 26 0526 - Grounding and Bonding: Additional requirements for grounding conductors and grounding connectors.
- C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 260918 - Lighting Control System.
- E. Section 260923 - Lighting Control Devices.
- F. Section 26 2100 - Electrical Service Entrance: Additional requirements for electrical service conductors.
- G. Section 28 4600 - Fire Detection and Alarm: Fire alarm system conductors and cables.

#### 1.3 REFERENCE STANDARDS

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013.
- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011.
- C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010 (Reapproved 2014).
- D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2014).
- E. ASTM B800 - Standard Specification for 8000 Series Aluminum Alloy Wire for Electrical Purposes - Annealed and Intermediate Tempers; 2005 (Reapproved 2011).
- F. ASTM B801 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy Wire for Subsequent Covering of Insulation; 2007 (Reapproved 2012).
- G. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2010.



- H. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2013.
- I. FS A-A-59544 - Cable and Wire, Electrical (Power, Fixed Installation); Federal Specification; Revision A, 2008.
- J. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- K. NECA 104 - Recommended Practice for Installing Aluminum Building Wire and Cable; 2012.
- L. NEMA WC 70 - Nonshielded Power Cable 2000 V or Less for the Distribution of Electrical Energy; 2009.
- M. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- N. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.
- O. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.
- P. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.
- Q. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.
- R. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.
- S. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
  - 2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
  - 3. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

#### 1.5 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

### PART 2 PRODUCTS

#### 2.1 CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
- C. Nonmetallic-sheathed cable is not permitted.
- D. Underground feeder and branch-circuit cable is not permitted.
- E. Service entrance cable is not permitted.
- F. Armored cable is not permitted.
- G. Metal-clad cable is not permitted.

## 2.2 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Provide new conductors and cables manufactured not more than one year prior to installation.
- D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- E. Comply with NEMA WC 70.
- F. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- G. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- H. Conductors for Grounding and Bonding: Also comply with Section 26 0526.
- I. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.
- J. Conductor Material:
  - 1. Provide copper conductors except where aluminum conductors are specifically indicated or permitted for substitution. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.
    - a. Substitution of aluminum conductors for copper is permitted, when approved by Owner and authority having jurisdiction, only for the following:
      - 1) Services: Copper conductors size 1/0 AWG and larger.
      - 2) Feeders: Copper conductors rated 100 Amps and larger..
    - b. Where aluminum conductors are substituted for copper, comply with the following:
      - 1) Size aluminum conductors to provide, when compared to copper sizes indicated, equivalent or greater ampacity and equivalent or less voltage drop.
      - 2) Increase size of raceways, boxes, wiring gutters, enclosures, etc. as required to accommodate aluminum conductors.
      - 3) Provide aluminum equipment grounding conductor sized according to NFPA 70.
      - 4) Equip electrical distribution equipment with compression lugs for terminating aluminum conductors.

2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
  3. Tinned Copper Conductors: Comply with ASTM B33.
  4. Aluminum Conductors (only where specifically indicated or permitted for substitution): AA-8000 series aluminum alloy conductors recognized by ASTM B800 and compact stranded in accordance with ASTM B801 unless otherwise indicated.
- K. Minimum Conductor Size:
1. Branch Circuits: 12 AWG.
    - a. Exceptions:
      - 1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
      - 2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
  2. Control Circuits: 14 AWG.
- L. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- M. Conductor Color Coding:
1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
  2. Color Coding Method: Integrally colored insulation.
    - a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
  3. Color Code:
    - a. 208Y/120 V, 3 Phase, 4 Wire System:
      - 1) Phase A: Black.
      - 2) Phase B: Red.
      - 3) Phase C: Blue.
      - 4) Neutral/Grounded: White.
    - b. Equipment Ground, All Systems: Green.
    - c. Travelers for 3-Way and 4-Way Switching: Purple.
    - d. For control circuits, comply with manufacturer's recommended color code.
- ## 2.3 SINGLE CONDUCTOR BUILDING WIRE
- A. Manufacturers:
1. Copper Building Wire:
    - a. Cerro Wire LLC: [www.cerrowire.com](http://www.cerrowire.com).
    - b. Encore Wire Corporation: [www.encorewire.com](http://www.encorewire.com).
    - c. Southwire Company: [www.southwire.com](http://www.southwire.com).
- B. Description: Single conductor insulated wire.
- C. Conductor Stranding:
1. Feeders and Branch Circuits:
    - a. Size 10 AWG and Smaller: Solid.
    - b. Size 8 AWG and Larger: Stranded.
  2. Control Circuits: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation:
1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
    - a. Size 4 AWG and Larger: Type XHHW-2.

- b. Installed Underground: Type XHHW-2.
- c. Fixture Wiring Within Luminaires: Type TFFN/TFN for luminaires with labeled maximum temperature of 90 degrees C; Approved suitable type for luminaires with labeled maximum temperature greater than 90 degrees C.
- 2. Aluminum Building Wire (only where specifically indicated or permitted for substitution): Type XHHW-2.

## 2.4 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
- B. Wiring Connectors for Splices and Taps:
  - 1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
  - 2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
- C. Wiring Connectors for Terminations:
  - 1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
  - 2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
  - 3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
  - 4. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
  - 5. Conductors for Control Circuits: Use crimped terminals for all connections.
- D. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.
- E. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.
- F. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
  - 1. Manufacturers:
    - a. 3M: [www.3m.com](http://www.3m.com).
    - b. Ideal Industries, Inc: [www.idealindustries.com](http://www.idealindustries.com).
    - c. NSI Industries LLC: [www.nsiindustries.com](http://www.nsiindustries.com).
- G. Mechanical Connectors: Provide bolted type or set-screw type.
  - 1. Manufacturers:
    - a. Burndy LLC: [www.burndy.com](http://www.burndy.com).
    - b. IlSCO: [www.ilSCO.com](http://www.ilSCO.com).
    - c. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com).
- H. Compression Connectors: Provide circumferential type or hex type crimp configuration.
  - 1. Manufacturers:
    - a. Burndy LLC: [www.burndy.com](http://www.burndy.com).
    - b. IlSCO: [www.ilSCO.com](http://www.ilSCO.com).
    - c. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com).

- I. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.
  - 1. Manufacturers:
    - a. Burndy LLC: [www.burndy.com](http://www.burndy.com).
    - b. IlSCO: [www.ilsco.com](http://www.ilsco.com).
    - c. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com).

## 2.5 WIRING ACCESSORIES

- A. Electrical Tape:
  - 1. Manufacturers:
    - a. 3M: [www.3m.com](http://www.3m.com).
    - b. Plymouth Rubber Europa: [www.plymouthrubber.com](http://www.plymouthrubber.com).
  - 2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
  - 3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
  - 4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
  - 5. Varnished Cambric Electrical Tape: Cotton cambric fabric tape, with or without adhesive, oil-primed and coated with high-grade insulating varnish; minimum thickness of 7 mil; suitable for continuous temperature environment up to 221 degrees F.
- B. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
- C. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.
  - 1. Manufacturers:
    - a. 3M: [www.3m.com](http://www.3m.com).
    - b. American Polywater Corporation: [www.polywater.com](http://www.polywater.com).
    - c. Ideal Industries, Inc: [www.idealindustries.com](http://www.idealindustries.com).
- D. Cable Ties: Material and tensile strength rating suitable for application.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that work likely to damage wire and cable has been completed.
- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- D. Verify that field measurements are as indicated.
- E. Verify that conditions are satisfactory for installation prior to starting work.

### 3.2 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

### 3.3 INSTALLATION

- A. Circuiting Requirements:
  - 1. Unless dimensioned, circuit routing indicated is diagrammatic.
  - 2. When circuit destination is indicated without specific routing, determine exact routing required.
  - 3. Arrange circuiting to minimize splices.
  - 4. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
  - 5. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
    - a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
    - b. Increase size of conductors as required to account for ampacity derating.
    - c. Size raceways, boxes, etc. to accommodate conductors.
  - 6. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is permitted where not otherwise prohibited, except for the following:
    - a. Branch circuits fed from ground fault circuit interrupter (GFCI) circuit breakers.
    - b. Branch circuits fed from feed-through protection of GFI receptacles.
    - c. Branch circuits with dimming controls.
  - 7. Provide oversized neutral/grounded conductors where indicated and as specified below.
    - a. Provide #10 AWG conductor for all 20 amp branch circuits with shared neutral..
- B. Install products in accordance with manufacturer's instructions.
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Install aluminum conductors in accordance with NECA 104.
- E. Installation in Raceway:
  - 1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
  - 2. Pull all conductors and cables together into raceway at same time.
  - 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
  - 4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- F. Exposed Cable Installation (only where specifically permitted):
  - 1. Route cables parallel or perpendicular to building structural members and surfaces.
  - 2. Protect cables from physical damage.
- G. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

- H. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
    - 1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
  - I. Install conductors with a minimum of 12 inches of slack at each outlet.
  - J. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
  - K. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
  - L. Make wiring connections using specified wiring connectors.
    - 1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
    - 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
    - 3. Do not remove conductor strands to facilitate insertion into connector.
    - 4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
    - 5. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.
    - 6. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
    - 7. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
  - M. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
  - N. Insulate ends of spare conductors using vinyl insulating electrical tape.
  - O. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.
  - P. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
  - Q. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.
- 3.4 FIELD QUALITY CONTROL
- A. See Section 01 4000 - Quality Requirements, for additional requirements.
  - B. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION 26 0519

## SECTION 26 0526 - GROUNDING AND BONDING

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.
- D. Ground bars.
- E. Ground rod electrodes.

#### 1.2 RELATED REQUIREMENTS

- A. Section 26 0519 - Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
- B. Section 26 0536 - Cable Trays: Additional grounding and bonding requirements for cable tray systems.
- C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 5600 - Exterior Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.

#### 1.3 REFERENCE STANDARDS

- A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2012.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2007.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Verify exact locations of underground metal water service pipe entrances to building.
  - 2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
  - 3. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
- B. Sequencing:
  - 1. Do not install ground rod electrodes until final backfill and compaction is complete.



## 1.5 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

## PART 2 PRODUCTS

### 2.1 GROUNDING AND BONDING REQUIREMENTS

- A. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- D. Grounding System Resistance:
  - 1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Engineer. Precipitation within the previous 48 hours does not constitute normally dry conditions.
  - 2. Grounding Electrode System: Not greater than 25 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
- E. Grounding Electrode System:
  - 1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
    - a. Provide continuous grounding electrode conductors without splice or joint.
    - b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
  - 2. Metal Underground Water Pipe(s):
    - a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
    - b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
    - c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
  - 3. Metal In-Ground Support Structure:
    - a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
  - 4. Concrete-Encased Electrode:
    - a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not

- smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
5. Ground Rod Electrode(s):
    - a. Provide two electrodes unless otherwise indicated or required.
    - b. Space electrodes not less than 10 feet from each other and any other ground electrode.
    - c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
  6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
  7. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
    - a. Ground Bar Size: 1/4 by 4 by 12 inches unless otherwise indicated or required.
    - b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
    - c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.
- F. Service-Supplied System Grounding:
1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
  2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.
  3. All metallic meter enclosures, CT Cabinets, and metallic conduit shall be bonded to the system per the NEC.
- G. Separately Derived System Grounding:
1. Separately derived systems include, but are not limited to:
    - a. Transformers (except autotransformers such as buck-boost transformers).
    - b. Generators, when neutral is switched in the transfer switch.
  2. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
  3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
  4. Outdoor Source: Where the source of the separately derived system is located outside the building or structure supplied, provide connection to grounding electrode at source in accordance with NFPA 70.
  5. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between

neutral (grounded) conductors and ground on load side of separately derived system disconnect.

6. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.

H. Bonding and Equipment Grounding:

1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
  - a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
  - b. Metal gas piping.

I. Communications Systems Grounding and Bonding:

1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
  - a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
  - b. Raceway Size: 3/4 inch trade size unless otherwise indicated or required.
  - c. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
  - d. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

J. Cable Tray Systems: Also comply with Section 26 0536.

K. Pole-Mounted Luminaires: Also comply with Section 26 5600.

## 2.2 GROUNDING AND BONDING COMPONENTS

A. General Requirements:

1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0526:

1. Use insulated copper conductors unless otherwise indicated.

- a. Exceptions:
  - 1) Use bare copper conductors where installed underground in direct contact with earth.
  - 2) Use bare copper conductors where directly encased in concrete (not in raceway).
- C. Connectors for Grounding and Bonding:
  - 1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
  - 2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
  - 3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
  - 4. Manufacturers - Mechanical and Compression Connectors:
    - a. Advanced Lightning Technology (ALT): [www.altfab.com](http://www.altfab.com).
    - b. Harger Lightning & Grounding: [www.harger.com](http://www.harger.com).
    - c. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com).
  - 5. Manufacturers - Exothermic Welded Connections:
    - a. Cadweld, a brand of Erico International Corporation: [www.erico.com](http://www.erico.com).
    - b. ThermOweld, a brand of Continental Industries, Inc: [www.thermoweld.com](http://www.thermoweld.com).
- D. Ground Bars:
  - 1. Description: Copper rectangular ground bars with mounting brackets and insulators.
  - 2. Size: As indicated.
  - 3. Holes for Connections: As indicated or as required for connections to be made.
  - 4. Manufacturers:
    - a. Erico International Corporation: [www.erico.com](http://www.erico.com).
    - b. Harger Lightning & Grounding: [www.harger.com](http://www.harger.com).
    - c. ThermOweld, a brand of Continental Industries, Inc: [www.thermoweld.com](http://www.thermoweld.com).
- E. Ground Rod Electrodes:
  - 1. Comply with NEMA GR 1.
  - 2. Material: Copper-bonded (copper-clad) steel.
  - 3. Size: 5/8 inch diameter by 10 feet length, unless otherwise indicated.
  - 4. Manufacturers:
    - a. Erico International Corporation: [www.erico.com](http://www.erico.com).
    - b. Galvan Industries, Inc: [www.galvanelectrical.com](http://www.galvanelectrical.com).
    - c. Harger Lightning & Grounding: [www.harger.com](http://www.harger.com).

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that conditions are satisfactory for installation prior to starting work.

### 3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).

- C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
  - 1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.
- D. Make grounding and bonding connections using specified connectors.
  - 1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
  - 2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
  - 3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
  - 4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
  - 5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- E. Identify grounding and bonding system components in accordance with Section 26 0553.

END OF SECTION 26 0526

## SECTION 26 0529 - HANGERS AND SUPPORTS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

#### 1.2 RELATED REQUIREMENTS

- A. Section 26 0533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.
- B. Section 26 0536 - Cable Trays: Additional support and attachment requirements for cable tray.
- C. Section 26 0533.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.
- D. Section 26 5100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.
- E. Section 26 5600 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

#### 1.3 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2013.
- D. MFMA-4 - Metal Framing Standards Publication; 2004.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
  - 2. Coordinate the work with other trades to provide additional framing and materials required for installation.
  - 3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
  - 4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.

5. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.5 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with applicable building code.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:

1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of 1.25. Include consideration for vibration, equipment operation, and shock loads where applicable.
4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
  - a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
  - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel or stainless steel unless otherwise indicated.
  - c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
  - d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.

1. Conduit Straps: One-hole or two-hole type; steel.
2. Conduit Clamps: Bolted type unless otherwise indicated.
3. Manufacturers:
  - a. Cooper Crouse-Hinds, a division of Eaton Corporation: [www.cooperindustries.com](http://www.cooperindustries.com).
  - b. Erico International Corporation: [www.erico.com](http://www.erico.com).
  - c. O-Z/Gedney, a brand of Emerson Industrial Automation: [www.emersonindustrial.com](http://www.emersonindustrial.com).
  - d. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com).

- C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
  - 1. Manufacturers:
    - a. Cooper Crouse-Hinds, a division of Eaton Corporation: [www.cooperindustries.com](http://www.cooperindustries.com).
    - b. Erico International Corporation: [www.erico.com](http://www.erico.com).
    - c. O-Z/Gedney, a brand of Emerson Industrial Automation: [www.emersonindustrial.com](http://www.emersonindustrial.com).
    - d. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com).
- D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
  - 1. Comply with MFMA-4.
  - 2. Channel Material:
    - a. Indoor Dry Locations: Use galvanized steel.
    - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
  - 3. Manufacturers:
    - a. Cooper B-Line, a division of Eaton Corporation: [www.cooperindustries.com](http://www.cooperindustries.com).
    - b. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com).
    - c. Unistrut, a brand of Atkore International Inc: [www.unistrut.com](http://www.unistrut.com).
    - d. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
- E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
  - 1. Minimum Size, Unless Otherwise Indicated or Required:
    - a. Equipment Supports: 1/2 inch diameter.
    - b. Single Conduit up to 1 inch (27 mm) trade size: 1/4 inch diameter.
    - c. Single Conduit larger than 1 inch (27 mm) trade size: 3/8 inch diameter.
    - d. Trapeze Support for Multiple Conduits: 3/8 inch diameter.
    - e. Outlet Boxes: 1/4 inch diameter.
    - f. Luminaires: 1/4 inch diameter.
- F. Anchors and Fasteners:
  - 1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
  - 2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
  - 3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
  - 4. Hollow Masonry: Use toggle bolts.
  - 5. Hollow Stud Walls: Use toggle bolts.
  - 6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
  - 7. Sheet Metal: Use sheet metal screws.
  - 8. Wood: Use wood screws.
  - 9. Plastic and lead anchors are not permitted.
  - 10. Powder-actuated fasteners are not permitted.
  - 11. Hammer-driven anchors and fasteners are not permitted.
  - 12. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    - a. Comply with MFMA-4.
    - b. Channel Material: Use galvanized steel.
    - c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
  - 13. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.
  - 14. Manufacturers - Mechanical Anchors:



- a. Hilti, Inc: [www.us.hilti.com](http://www.us.hilti.com).
- b. Powers Fasteners, Inc: [www.powers.com](http://www.powers.com).

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- E. Unless specifically indicated or approved by Engineer, do not provide support from suspended ceiling support system or ceiling grid.
- F. Unless specifically indicated or approved by Engineer, do not provide support from roof deck.
- G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- H. Equipment Support and Attachment:
  - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
  - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
  - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
  - 4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 3 inch high concrete pad constructed in accordance with Section 03 3000.
  - 5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- I. Conduit Support and Attachment: Also comply with Section 26 0533.13.
- J. Cable Tray Support and Attachment: Also comply with Section 26 0536.
- K. Box Support and Attachment: Also comply with Section 26 0533.16.
- L. Interior Luminaire Support and Attachment: Also comply with Section 26 5100.
- M. Exterior Luminaire Support and Attachment: Also comply with Section 26 5600.
- N. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

- O. Secure fasteners according to manufacturer's recommended torque settings.
- P. Remove temporary supports.

3.3 FIELD QUALITY CONTROL

- A. Inspect support and attachment components for damage and defects.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 26 0529

## SECTION 26 0533.13 - CONDUIT FOR ELECTRICAL SYSTEMS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Intermediate metal conduit (IMC).
- C. PVC-coated galvanized steel rigid metal conduit (RMC).
- D. Flexible metal conduit (FMC).
- E. Liquid-tight flexible metal conduit (LFMC).
- F. Electrical metallic tubing (EMT).
- G. Rigid polyvinyl chloride (PVC) conduit.
- H. Conduit fittings.
- I. Accessories.

#### 1.2 RELATED REQUIREMENTS

- A. Section 07 8400 - Firestopping.
- B. Section 26 0519 - Conductors and Cables.
- C. Section 26 0526 - Grounding and Bonding.
  - 1. Includes additional requirements for fittings for grounding and bonding.
- D. Section 26 0529 - Hangers and Supports.
- E. Section 26 2100 - Electrical Service Entrance: Additional requirements for electrical service conduits.
- F. Section 27 1005 - Structured Cabling for Voice and Data: Additional requirements for communications systems conduits.

#### 1.3 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2005.
- B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); 2005.
- C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit (EIMC); 2005.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2013.
- F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2003.
- G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2012.
- H. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2013.

- I. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2015.
- J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.
- L. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
- M. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.
- N. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
- O. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.
- P. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.
- Q. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
  - 2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
  - 3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
  - 4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
  - 5. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
- B. Sequencing:
  - 1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

#### 1.5 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

### PART 2 PRODUCTS

#### 2.1 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies,

comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:

1. Under Slab on Grade: Use galvanized steel rigid metal conduit, PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit, PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
3. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
4. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows or PVC-coated galvanized steel rigid metal conduit elbows for bends.
5. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape to provide supplementary corrosion protection or use PVC-coated galvanized steel rigid metal conduit.
6. Where steel conduit emerges from concrete into soil, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches on either side of where conduit emerges or use PVC-coated galvanized steel rigid metal conduit.

D. Embedded Within Concrete:

1. Within Slab on Grade: Not permitted.

E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

K. Exposed, Exterior: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

L. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

M. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.  
1. Maximum Length: 6 feet.

N. Connections to Vibrating Equipment:

1. Dry Locations: Use flexible metal conduit.
2. Damp, Wet, or Corrosive Locations: Use liquid-tight flexible metal conduit.
3. Maximum Length: 3 feet unless otherwise indicated.

4. Vibrating equipment includes, but is not limited to:
  - a. Transformers.
  - b. Motors.
  - c. Generators.

## 2.2 CONDUIT REQUIREMENTS

- A. Electrical Service Conduits: Also comply with Section 26 2100.
- B. Communications Systems Conduits: Also comply with Section 27 1005.
- C. Fittings for Grounding and Bonding: Also comply with Section 26 0526.
- D. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.
- E. Provide products listed, classified, and labeled as suitable for the purpose intended.
- F. Minimum Conduit Size, Unless Otherwise Indicated:
  1. Branch Circuits: 3/4 inch (21 mm) trade size.
  2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
  3. Flexible Connections to Luminaires: 1/2 inch (16 mm) trade size.
  4. Underground, Interior: 3/4 inch (21 mm) trade size.
  5. Underground, Exterior: 3/4 inch (21 mm) trade size.
- G. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

## 2.3 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- B. Fittings:
  1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  2. Material: Use steel.
    - a. Do not use die cast zinc fittings.
  3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

## 2.4 INTERMEDIATE METAL CONDUIT (IMC)

- A. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
- B. Fittings:
  1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  2. Material: Use steel.
    - a. Do not use die cast zinc fittings.
  3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

## 2.5 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.

- B. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil.
- C. PVC-Coated Fittings:
  - 1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
  - 2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
  - 3. Material: Use steel.
  - 4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil.
- D. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil.

## 2.6 FLEXIBLE METAL CONDUIT (FMC)

- A. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.
- B. Fittings:
  - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  - 2. Material: Use steel.
    - a. Do not use die cast zinc fittings.

## 2.7 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- B. Fittings:
  - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  - 2. Material: Use steel.
    - a. Do not use die cast zinc fittings.

## 2.8 ELECTRICAL METALLIC TUBING (EMT)

- A. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
  - 1. Provided factory painted conduit as indicated in 26 05 53 Identification for Electrical Systems
- B. Fittings:
  - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  - 2. Material: Use steel.
    - a. Do not use die cast zinc fittings.
  - 3. Connectors and Couplings: Use compression (gland) or set-screw type.
    - a. Do not use indenter type connectors and couplings.
  - 4. Damp or Wet Locations (where permitted): Use fittings listed for use in wet locations.

## 2.9 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

- B. Fittings:
  - 1. Manufacturer: Same as manufacturer of conduit to be connected.
  - 2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

## 2.10 ACCESSORIES

- A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil.
- B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.
- C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- D. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.
- E. Modular Seals for Conduit Penetrations: Rated for minimum of 40 psig; Suitable for the conduits to be installed.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that mounting surfaces are ready to receive conduits.
- B. Verify that conditions are satisfactory for installation prior to starting work.

### 3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Install intermediate metal conduit (IMC) in accordance with NECA 101.
- E. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.
- F. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- G. Conduit Routing:
  - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
  - 2. When conduit destination is indicated without specific routing, determine exact routing required.
  - 3. Conceal all conduits unless specifically indicated to be exposed.
  - 4. Conduits in the following areas may be exposed, unless otherwise indicated:
    - a. Electrical rooms.
    - b. Mechanical equipment rooms.
    - c. Within joists in areas with no ceiling.
  - 5. Unless otherwise approved, do not route conduits exposed:
    - a. Across floors.
    - b. Across roofs.
    - c. Across top of parapet walls.
    - d. Across building exterior surfaces.



6. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
  7. Arrange conduit to maintain adequate headroom, clearances, and access.
  8. Arrange conduit to provide no more than the equivalent of three 90 degree bends between pull points.
  9. Arrange conduit to provide no more than 150 feet between pull points.
  10. Route conduits above water and drain piping where possible.
  11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
  12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
  13. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
    - a. Heaters.
    - b. Hot water piping.
    - c. Flues.
  14. Group parallel conduits in the same area together on a common rack.
- H. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
  2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
  3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
  4. Use conduit strap to support single surface-mounted conduit.
    - a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
  5. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
  6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
  7. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
  8. Use of spring steel conduit clips for support of conduits is not permitted.
    - a. Support of electrical metallic tubing (EMT) up to 1 inch (27 mm) trade size concealed above accessible ceilings and within hollow stud walls.
    - b. Spring clips shall not be used to support conduits to ceiling support wires..
  9. Use of wire for support of conduits is not permitted.
  10. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with the most stringent requirements.
- I. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
  2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
  3. Use suitable adapters where required to transition from one type of conduit to another.
  4. Provide drip loops for liquid-tight flexible conduit connections to prevent drainage of liquid into connectors.

5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
  6. Where spare conduits stub up through concrete floors and are not terminated in a box or enclosure, provide threaded couplings equipped with threaded plugs.
  7. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
  8. Secure joints and connections to provide maximum mechanical strength and electrical continuity.
- J. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
  2. Make penetrations perpendicular to surfaces unless otherwise indicated.
  3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
  4. Conceal bends for conduit risers emerging above ground.
  5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
  6. Provide suitable modular seal where conduits penetrate exterior wall below grade.
  7. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
  8. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
  9. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
- K. Underground Installation:
1. Provide trenching and backfilling as required.
  2. Minimum Cover, Unless Otherwise Indicated or Required:
    - a. Underground, Exterior: 24 inches.
  3. Provide underground warning tape in accordance with Section 26 0553 along entire conduit length for service entrance where not concrete-encased.
- L. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
  2. Where conduits are subject to earth movement by settlement or frost.
- M. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
  2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
- N. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.
- O. Provide grounding and bonding in accordance with Section 26 0526.

- P. Install no more than equivalent of four 90 degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one shot bender to fabricate bends in metal conduit larger than 1 1/4 inch size.

### 3.3 FIELD QUALITY CONTROL

- A. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- B. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.
- C. Correct deficiencies and replace damaged or defective conduits.

### 3.4 CLEANING

- A. Clean interior of conduits to remove moisture and foreign matter.

### 3.5 PROTECTION

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION 26 0533.13

## SECTION 26 0533.16 - BOXES FOR ELECTRICAL SYSTEMS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.
- B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.
- C. Floor boxes.
- D. Underground boxes/enclosures.

#### 1.2 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete.
- B. Section 08 3100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.
- C. Section 26 0529 - Hangers and Supports.
- D. Section 26 0533.13 - Conduit for Electrical Systems:
  - 1. Conduit bodies and other fittings.
  - 2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.
- E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 26 2726 - Wiring Devices:
  - 1. Wall plates.
  - 2. Floor box service fittings.
  - 3. Poke-through assemblies.
  - 4. Additional requirements for locating boxes for wiring devices.
- G. Section 27 1005 - Structured Cabling for Voice and Data: Additional requirements for communications systems outlet boxes.

#### 1.3 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.
- C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2012.
- D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013.
- E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. SCTE 77 - Specification for Underground Enclosure Integrity; 2013.

- H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- I. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
  - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
  - 3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
  - 4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
  - 5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
  - 6. Coordinate the work with other trades to preserve insulation integrity.
  - 7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
  - 8. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

#### 1.5 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

### PART 2 PRODUCTS

#### 2.1 BOXES

- A. General Requirements:
  - 1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
  - 2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
  - 3. Provide products listed, classified, and labeled as suitable for the purpose intended.
  - 4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
  - 5. Provide grounding terminals within boxes where equipment grounding conductors terminate.
- B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
  - 1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.

2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
  3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
  4. Use suitable concrete type boxes where flush-mounted in concrete.
  5. Use suitable masonry type boxes where flush-mounted in masonry walls.
  6. Use raised covers suitable for the type of wall construction and device configuration where required.
  7. Use shallow boxes where required by the type of wall construction.
  8. Do not use "through-wall" boxes designed for access from both sides of wall.
  9. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
  10. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
  11. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
  12. Boxes for Ganged Devices: Use multi-gang boxes of single-piece construction. Do not use field-connected gangable boxes.
  13. Minimum Box Size, Unless Otherwise Indicated:
    - a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
    - b. Communications Systems Outlets: Comply with Section 27 1005.
    - c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
  14. Wall Plates: Comply with Section 26 2726.
  15. Manufacturers:
    - a. Cooper Crouse-Hinds, a division of Eaton Corporation: [www.cooperindustries.com](http://www.cooperindustries.com).
    - b. Hubbell Incorporated; Bell Products: [www.hubbell-rtb.com](http://www.hubbell-rtb.com).
    - c. Hubbell Incorporated; RACO Products: [www.hubbell-rtb.com](http://www.hubbell-rtb.com).
    - d. O-Z/Gedney, a brand of Emerson Industrial Automation: [www.emersonindustrial.com](http://www.emersonindustrial.com).
    - e. Thomas & Betts Corporation: [www.tnb.com](http://www.tnb.com).
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
  2. NEMA 250 Environment Type, Unless Otherwise Indicated:
    - a. Indoor Clean, Dry Locations: Type 1, painted steel.
    - b. Outdoor Locations: Type 3R, painted steel.
  3. Junction and Pull Boxes Larger Than 100 cubic inches:
    - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
- D. Floor Boxes:
1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 26 2726; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
  2. Use cast iron floor boxes within slab on grade.
  3. Use sheet-steel or cast iron floor boxes within slab above grade.

4. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).
5. Manufacturer: Same as manufacturer of floor box service fittings.
- E. Underground Boxes/Enclosures:
  1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.
  2. Size: As indicated on drawings or as required.
  3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches.
  4. Provide logo on cover to indicate type of service.
  5. Applications:
    - a. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.
  6. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.
    - a. Manufacturers:
      - 1) Hubbell Incorporated; Quazite Products:  
[www.hubbellpowersystems.com](http://www.hubbellpowersystems.com).
    - b. Combination fiberglass/polymer concrete boxes/enclosures are acceptable.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that mounting surfaces are ready to receive boxes.
- B. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide separate boxes for emergency power and normal power systems.
- E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
- F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.
- H. Box Locations:
  1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 3100 as required where approved by the Architect.
  2. Unless dimensioned, box locations indicated are approximate.
  3. Locate boxes as required for devices installed under other sections or by others.
    - a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 2726.
    - b. Communications Systems Outlets: Comply with Section 27 1005.

4. Locate boxes so that wall plates do not span different building finishes.
  5. Locate boxes so that wall plates do not cross masonry joints.
  6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
  7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
  8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
  9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
    - a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
    - b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
  10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 0533.13.
  11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
    - a. Concealed above accessible suspended ceilings.
    - b. Within joists in areas with no ceiling.
    - c. Electrical rooms.
    - d. Mechanical equipment rooms.
- I. Box Supports:
1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
  2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
  3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
  4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.
- J. Install boxes plumb and level.
- K. Flush-Mounted Boxes:
1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
  2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
  3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.
- L. Install boxes as required to preserve insulation integrity.



- M. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.
  - N. Underground Boxes/Enclosures:
    - 1. Install enclosure on gravel base, minimum 6 inches deep.
    - 2. Mount enclosures located in landscaped areas with top at 1 inch above finished grade.
    - 3. Provide cast-in-place concrete collar constructed in accordance with Section 03 3000, minimum 10 inches wide by 12 inches deep, around enclosures that are not located in concrete areas.
    - 4. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.
  - O. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
  - P. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.
  - Q. Close unused box openings.
  - R. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
  - S. Provide grounding and bonding in accordance with Section 26 0526.
  - T. Identify boxes in accordance with Section 26 0553.
  - U. Secure flush mounting box to interior wall and partition studs with external to box fasteners. Accurately position to allow for surface finish thickness.
- 3.3 CLEANING
- A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.
- 3.4 PROTECTION
- A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION 26 0533.16

## SECTION 26 0536 - CABLE TRAYS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Metal cable tray systems:
  - 1. Metal ladder cable tray.
  - 2. Metal wire mesh/basket cable tray.
- B. Cable trays and accessories.
- C. Firestopping within (not around) cable trays.

#### 1.2 RELATED REQUIREMENTS

- A. Section 07 8400 - Firestopping.
- B. Section 26 0526 - Grounding and Bonding.
- C. Section 26 0529 - Hangers and Supports.
- D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 27 1005 - Structured Cabling for Voice and Data.

#### 1.3 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2013.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- E. NECA/BICSI 568 - Standard for Installing Building Telecommunications Cabling; National Electrical Contractors Association; 2006.
- F. NEMA FG 1 - Fiberglass Cable Tray Systems; 1993 (with Rev 1; 1994).
- G. NEMA VE 1 - Metal Cable Tray Systems; 2009.
- H. NEMA VE 2 - Cable Tray Installation Guidelines; 2013.
- I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the arrangement of cable tray with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others. Coordinate the work with other trades to avoid installation of obstructions within cable tray required clearances.

2. Coordinate arrangement of cable tray with the dimensions and clearance requirements of the actual products to be installed.
  3. Coordinate the work with placement of supports, anchors, etc. required for mounting.
  4. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
- B. Preinstallation Meeting: Convene one week prior to commencing work of this section; require attendance of all affected installers. Review proposed routing, sequence of installation, and protection requirements for installed cable tray.
- C. Sequencing:
1. Do not begin installation of cables until installation of associated cable tray run is complete.

#### 1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cable tray system components and accessories. Include dimensions, materials, fabrication details, finishes, and span/load ratings.
- C. Shop Drawings: Include dimensioned plan views and sections indicating proposed cable tray routing, required clearances, and locations and details of supports, fittings, building element penetrations, and equipment connections.
- D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Project Record Documents: Record actual routing of cable tray and locations of supports.

#### 1.6 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

### PART 2 PRODUCTS

#### 2.1 CABLE TRAY SYSTEM - GENERAL REQUIREMENTS

- A. Provide new cable tray system consisting of all required components, fittings, supports, accessories, etc. as necessary for a complete system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Do not use cable tray for applications other than as permitted by NFPA 70 and product listing/classification.
- D. Provide cable tray system and associated components suitable for use at indicated span/load ratings under the service conditions at the installed location.

- E. Unless otherwise indicated, specified span/load ratings are according to NEMA VE 1 (metal cable tray systems) or NEMA FG 1 (fiberglass cable tray systems) with safety factor of 1.5 and working load only (no additional concentrated static load).
- F. Unless otherwise indicated, specified load/fill depths and inside widths are nominal values according to NEMA VE 1 (metal cable tray systems) or NEMA FG 1 (fiberglass cable tray systems) with applicable allowable tolerances.

## 2.2 METAL CABLE TRAY SYSTEMS

- A. Manufacturers:
  - 1. Metal Cable Tray System - Basis of Design: Cablofil.
  - 2. Metal Cable Tray System - Other Acceptable Manufacturers:
    - a. Cooper B-Line
    - b. Chatsworth
    - c. Cope, a brand of Atkore International Inc: [www.copecabletray.com](http://www.copecabletray.com).
- B. Comply with NEMA VE 1.
- C. Finishes:
  - 1. Zinc Electroplated Steel: Comply with ASTM B633.
  - 2. Mill-Galvanized Before Fabrication (Pre-Galvanized) Steel: Comply with ASTM A653/A653M, G90 coating.
- D. Metal Ladder Cable Tray:
  - 1. Material: Mill-galvanized before fabrication (pre-galvanized) steel.
  - 2. Side Rail Construction: I-beam or C-channel flange in.
  - 3. Load/Fill Depth: As indicated on drawings.
  - 4. Span/Load Rating: As indicated on drawings.
  - 5. Rung Spacing: 9 inches on center for straight lengths.
  - 6. Inside Width: As indicated on drawings.
  - 7. Inside Radius of Fittings: 12 inches.
- E. Metal Wire Mesh/Basket Cable Tray:
  - 1. Material: Zinc electroplated steel.
  - 2. Tray Depth: As indicated on drawings.
  - 3. Span/Load Rating: As indicated on drawings.
  - 4. Mesh Spacing: 2 by 4 inches.
  - 5. Tray Width: As indicated on drawings.
  - 6. Accessories: Provide all factory standard accessories from the same manufactures as tray, required for a complete system, including:
    - a. Splice Kits
    - b. Radius 90° and Tee Kits
    - c. Elevation change
    - d. Wall mount 'L' brackets or Center hang kits
    - e. Conduit and box supports
    - f. Cable exit and drop out kits
    - g. Grounding Lugs

## 2.3 SOURCE QUALITY CONTROL

- A. Metal Cable Tray: Perform factory design tests in accordance with NEMA VE 1, including electrical continuity and load testing.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that work likely to damage cable tray system has been completed.
- B. Verify that field measurements are as indicated.
- C. Verify that the dimensions and span/load ratings of cable tray system components are consistent with the indicated requirements.
- D. Verify that mounting surfaces are ready to receive cable tray and associated supports.
- E. Verify that conditions are satisfactory for installation prior to starting work.

### 3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install cable tray in accordance with NECA 1 (general workmanship), and NEMA VE 2.
- C. Unless otherwise indicated, arrange cable tray to be parallel or perpendicular to building lines.
- D. Arrange cable tray to provide required clearances and maintain cable access.
  - 1. Cable Tray for Telecommunications Cables: Maintain recommended separation from sources of EMI greater than 5 kVA in accordance with NECA/BICSI 568.
- E. Install cable tray plumb and level, with sections aligned and with horizontal runs at the proper elevation.
- F. Metal Wire Mesh/Basket Cable Tray: Field fabricate fittings in accordance with manufacturer's instructions, using only manufacturer-approved connectors classified for bonding.
  - 1. Inside Radius of Fittings: 12 inches.
- G. Cable Tray Movement Provisions:
  - 1. Provide suitable expansion fittings where cable tray is subject to movement, including but not limited to:
    - a. Where cable tray crosses structural joints intended for expansion.
    - b. Long straight cable tray runs in accordance with NEMA VE 2.
  - 2. Use expansion guides in lieu of hold-down clamps where prescribed in NEMA VE 2.
  - 3. Set gaps for expansion fittings in accordance with NEMA VE 2.
- H. Cable Provisions:
  - 1. Use suitable fixed barrier strips to maintain separation of cables as indicated and as required by NFPA 70.
  - 2. Use suitable drop-out fittings or bushings where cables exit cable tray as required to maintain minimum cable bending radius.
  - 3. Use suitable cable support fittings for long vertical cable tray runs with heavy cables.
- I. Provide end closures at unconnected ends of cable tray runs.
- J. Cable Tray Support:
  - 1. Use manufacturer's recommended hangers and supports, located in accordance with NEMA VE 2 and manufacturer's requirements, but not exceeding specified span unless otherwise approved by Engineer. Provide required support and

- attachment components in accordance with Section 26 0529, where not furnished by cable tray manufacturer.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- K. Grounding and Bonding Requirements, in Addition to Requirements of Section 26 0526:
1. Comply with grounding and bonding requirements of NEMA VE 2.
  2. Metal Cable Tray Systems: Use suitable bonding jumpers or classified connectors to provide electrical continuity.
  3. Provide suitable equipment grounding conductor in each cable tray, except where cable tray contains only multiconductor cables with integral equipment grounding conductors. Do not use metal cable tray system as sole equipment grounding conductor.
    - a. Equipment Grounding Conductor for Steel Cable Tray: Use bare or insulated copper conductor.
    - b. Bond equipment grounding conductor to each cable tray section using suitable listed ground clamps. Separate bonding jumpers are not required where properly bonded equipment grounding conductor provides equivalent continuity.
- L. Cable Installation:
1. Comply with cable installation requirements of NEMA VE 2.
  2. Use appropriate cable pulling tools, applied to prevent excessive force on cable tray system and maintain minimum cable bending radius.
  3. Use cable clamps or cable ties to fasten conductors/cables to vertical and horizontal runs of cable tray.
    - a. Distance Between Fastening Points for Vertical Runs: 18 inches.
    - b. Distance Between Fastening Points for Horizontal Runs: As required to maintain spacing and confine conductor/cable within the cable fill area.
- M. Penetrations: Install firestopping to preserve fire resistance rating of building elements, using materials and methods specified in Section 07 8400.
- N. Identification Requirements, in Addition to Those Specified in Section 26 0553.
- 3.3 CLEANING
- A. Remove dirt and debris from cable tray.
  - B. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.
- 3.4 PROTECTION
- A. Protect cable tray system from subsequent construction operations.

END OF SECTION 26 0536

## SECTION 26 0545 - PATHWAYS FOR SECURITY SYSTEMS

### PART 1 GENERAL

#### 1.1 SCOPE OF WORK

- A. The contractor is held responsible to become familiar with the provisions contained herein and with other Sections of this Specification as applicable to the completion of the installation.
- B. Work covered by this Section shall consist of furnishing labor, equipment, supplies, materials, and all other materials necessary for a completed pathways inside and outside the building(s), as indicated on the drawings.

#### 1.2 SECTION INCLUDES

- A. Communications Pathways
- B. Television System Pathways
- C. Security System Pathways
- D. Control System Pathways
- E. Grounding and bonding.

#### 1.3 RELATED SECTIONS

- A. Section 26 0526 Grounding and Bonding for Electrical Systems
- B. Section 26 0534 Conduit
- C. Section 26 0535 Surface Raceways
- D. Section 26 0536 Cable Trays for Electrical Systems
- E. Section 26 0537 Boxes

### PART 2 PRODUCTS

#### 2.1 PRODUCT STANDARDS

- A. All materials shall conform to the current applicable industry standards including, but not limited to:
  - 1. NEMA (National Electrical Manufacturers' Association)
  - 2. NEC (National Electrical Code)
  - 3. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

- A. The electrical contractor shall provide and install all conduit to cable tray, pull wires, back boxes, termination backboards. The installation of Voice, Data, Security, or TV cabling, equipment, and termination will be bid out as part of another contract.
- B. Minimum size conduit shall be 3/4".

- C. All back boxes shall be 4" square boxes, 2 1/2" deep, with plaster rings and finish as specified in Section 26 0537, unless otherwise specified. Back boxes shall not be installed on common walls back to back. Provide a blank coverplate for all unused boxes.
- D. All back boxes shall be mounted at 18" above finished floor unless indicated otherwise, except wall phones shall be installed at 54" AFF. Where back boxes are indicated to be above a counter, back box shall be mounted 6" above counter surface. Contractor shall coordinate all boxes to be installed within casework.
- E. CCTV cameras shall be ceiling mounted or wall mounted, as shown on the drawings. Install wall mounted CCTV cameras at height recommended by Owner.
- F. The electrical contractor shall install a 3/4" sheet of plywood in all Telecommunication closets as indicated on the drawings. Provide 2 coats of gray fire retardant paint for each board.
- G. Long radius bends or elbows shall be used on all conduits 1 1/2" and larger in size.
- H. Do not install more than two (2) 90 degree bends in a single horizontal run, without installing a pull box.
- I. All conduits shall be provided with pull wire and have bushings installed.
- J. Provide service conduits for telephone, cable tv, and fiber optics as noted on the drawings. Coordinate all work with the Utility Companies and the University of Nebraska.
- K. Bond and ground all pathways in accordance with the NEC.
- L. Pathways requiring fire stopping shall utilize removable/re-usable fire stopping putties for ease of Moves, Adds, and Changes.
- M. All fire stopping penetrations shall conform to the recommended practices listed in UL1479 or ASTM E814 and must be labeled with the UL1479 or ASTM E814 reference number, dated, and signed by the technician who installed the fire stopping material.
- N. Coordinate all work with the University of Nebraska.
- O. Coordinate door access hardware with the hardware manufacturer.

END OF SECTION 26 0545



## SECTION 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Voltage markers.
- E. Underground warning tape.
- F. Warning signs and labels.

#### 1.2 RELATED REQUIREMENTS

- A. Section 09 9113 - Exterior Painting.
- B. Section 09 9123 - Interior Painting.
- C. Section 26 0519 - Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
- D. Section 26 0536 - Cable Trays: Additional identification requirements for cable tray systems.
- E. Section 262726 - Wiring Devices
- F. Section 27 1005 - Structured Cabling for Voice and Data: Identification for communications cabling and devices.

#### 1.3 REFERENCE STANDARDS

- A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2011.
- B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.
- B. Sequencing:
  - 1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
  - 2. Do not install identification products until final surface finishes and painting are complete.

## 1.5 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

## 1.6 FIELD CONDITIONS

- A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

## PART 2 PRODUCTS

### 2.1 IDENTIFICATION REQUIREMENTS

#### A. Identification for Equipment:

1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
  - a. Switchboards:
    - 1) Identify voltage and phase.
    - 2) Identify power source and circuit number..
    - 3) Use identification nameplate to identify main overcurrent protective device.
    - 4) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
  - b. Panelboards:
    - 1) Identify ampere rating.
    - 2) Identify voltage and phase.
    - 3) Identify power source and circuit number. Include location when not within sight of equipment.
    - 4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
    - 5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
    - 6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
  - c. Transformers:
    - 1) Identify power source and circuit number. Include location.
    - 2) Identify load(s) served. Include location when not within sight of equipment.
  - d. Enclosed switches, circuit breakers, and motor controllers:
    - 1) Identify voltage and phase.
    - 2) Identify power source and circuit number. Include location when not within sight of equipment.
    - 3) Identify load(s) served.
  - e. Transfer Switches:
    - 1) Identify voltage and phase.
    - 2) Identify power source and circuit number for both normal power source and standby power source. Include location when not within sight of equipment.
    - 3) Identify load(s) served..
    - 4) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.

2. Service Equipment:
    - a. Use identification nameplate to identify each service disconnecting means.
  3. Emergency System Equipment:
    - a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.
    - b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
  4. Use voltage marker to identify highest voltage present for each piece of electrical equipment.
  5. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
  6. Use identification label or handwritten text using indelible marker on inside of door at each fused switch to identify required NEMA fuse class and size.
  7. Use identification label or handwritten text using indelible marker on inside of door at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.
  8. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
  9. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70, including but not limited to the following.
    - a. Service equipment.
    - b. Industrial control panels.
    - c. Motor control centers.
    - d. Elevator control panels.
    - e. Industrial machinery.
- B. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.
  2. Identification for Communications Conductors and Cables: Comply with Section 27 1005.
  3. Use underground warning tape to identify direct buried cables.
- C. Identification for Boxes:
1. Use voltage markers or color coded boxes to identify systems other than normal power system.
    - a. Color-Coded Boxes: Field-painted in accordance with Section 09 9123 and 09 9113 per the same color code used for raceways.
  2. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
    - a. For exposed boxes in public areas, provide identification on inside face of cover.
- D. Identification for Devices:
1. Identification for Communications Devices: Comply with Section 27 1005.
  2. Wiring Device and Wallplate Finishes: Comply with Section 26 2726.
  3. Use identification label to identify fire alarm system devices.
  4. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.
    - a. For receptacles in public areas or in areas as directed by Architect, provide identification on inside surface of wallplate.
  5. Use identification label or engraved wallplate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.

6. Use identification label to identify receptacles protected by upstream GFI protection, where permitted.

## 2.2 IDENTIFICATION NAMEPLATES AND LABELS

### A. Identification Nameplates:

1. Materials:
  - a. Indoor Clean, Dry Locations: Use plastic nameplates.
  - b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

### B. Identification Labels:

1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
  - a. Use only for indoor locations.
2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

### C. Format for Equipment Identification:

1. Minimum Size: 1 inch by 2.5 inches.
2. Legend:
  - a. System designation where applicable:
  - b. Equipment designation or other approved description.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height:
  - a. System Designation: 1 inch.
  - b. Equipment Designation: 1/2 inch.
  - c. Other Information: 1/4 inch.
5. Color:
  - a. Normal Power System: White text on black background.
  - b. Emergency Power System: White text on red background.
  - c. Fire Alarm System: White text on red background.

### D. Format for General Information and Operating Instructions:

1. Minimum Size: 1 inch by 2.5 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/4 inch.
5. Color: Black text on white background unless otherwise indicated.

### E. Format for Caution and Warning Messages:

1. Minimum Size: 2 inches by 4 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.

4. Minimum Text Height: 1/2 inch.
5. Color: Black text on yellow background unless otherwise indicated.

## 2.3 WIRE AND CABLE MARKERS

- A. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.
- B. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.
- C. Legend: Power source and circuit number or other designation indicated.
- D. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
  1. Do not use handwritten text.
- E. Minimum Text Height: 1/8 inch.
- F. Color: Black text on white background unless otherwise indicated.

## 2.4 VOLTAGE MARKERS

- A. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.
- B. Minimum Size:
  1. Markers for Equipment: 1 1/8 by 4 1/2 inches.
  2. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
  3. Markers for Junction Boxes: 1/2 by 2 1/4 inches.
- C. Legend:
  1. Markers for Voltage Identification: Highest voltage present.
  2. Markers for System Identification:
    - a. Emergency Power System: Text "EMERGENCY".
- D. Color: Black text on orange background unless otherwise indicated.

## 2.5 UNDERGROUND WARNING TAPE

- A. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
- B. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.
- C. Legend: Type of service, continuously repeated over full length of tape.
- D. Color:
  1. Tape for Buried Power Lines: Black text on red background.
  2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

## 2.6 WARNING SIGNS AND LABELS

- A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
- B. Warning Signs:
  1. Materials:
    - a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.

2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
  3. Minimum Size: 7 by 10 inches unless otherwise indicated.
- C. Warning Labels:
1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
    - a. Do not use labels designed to be completed using handwritten text.
  2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
  3. Minimum Size: 2 by 4 inches unless otherwise indicated.

### PART 3 EXECUTION

#### 3.1 PREPARATION

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

#### 3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
1. Surface-Mounted Equipment: Enclosure front.
  2. Flush-Mounted Equipment: Inside of equipment door.
  3. Branch Devices: Adjacent to device.
  4. Interior Components: Legible from the point of access.
  5. Boxes: Outside face of cover.
  6. Conductors and Cables: Legible from the point of access.
- C. Install identification products centered, level, and parallel with lines of item being identified.
- D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.
- G. Secure rigid signs using stainless steel screws.
- H. Mark all handwritten text, where permitted, to be neat and legible.

#### 3.3 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION 26 0553

## SECTION 26 0583 - WIRING CONNECTIONS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Electrical connections to equipment.

#### 1.2 RELATED REQUIREMENTS

- A. Section 26 0519 - Conductors and Cables.
- B. Section 26 0533.13 - Conduit for Electrical Systems.
- C. Section 26 0533.16 - Boxes for Electrical Systems.
- D. Section 26 2726 - Wiring Devices.
- E. Section 26 2816.16 - Enclosed Switches.
- F. Section 26 2913 - Enclosed Controllers.

#### 1.3 REFERENCE STANDARDS

- A. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R 2010).
- B. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2012.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
  - 2. Determine connection locations and requirements.
- B. Sequencing:
  - 1. Install rough-in of electrical connections before installation of equipment is required.
  - 2. Make electrical connections before required start-up of equipment.

#### 1.5 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

- A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
  - 1. Colors: Conform to NEMA WD 1.
  - 2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.

- 3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.
- B. Disconnect Switches: As specified in Section 26 2816.16 and in individual equipment sections.
- C. Wiring Devices: As specified in Section 26 2726.
- D. Flexible Conduit: As specified in Section 26 0533.13.
- E. Wire and Cable: As specified in Section 26 0519.
- F. Boxes: As specified in Section 26 0533.16.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that equipment is ready for electrical connection, wiring, and energization.

#### 3.2 ELECTRICAL CONNECTIONS

- A. Make electrical connections in accordance with equipment manufacturer's instructions.
- B. Make conduit connections to equipment using flexible conduit. Use liquid-tight flexible conduit with watertight connectors in damp or wet locations.
- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- D. Provide receptacle outlet to accommodate connection with attachment plug.
- E. Provide cord and cap where field-supplied attachment plug is required.
- F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- H. Install terminal block jumpers to complete equipment wiring requirements.
- I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION 26 0583



## SECTION 26 0918 - LIGHTING CONTROL SYSTEMS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Programmable switching controls.
- B. Remote control switching relays.
- C. Remote switches.
- D. Remote sensors.
- E. Power supplies.
- F. Relay cabinets.

#### 1.2 RELATED REQUIREMENTS

- A. Section 26 0533.13 - Conduit for Electrical Systems.
- B. Section 26 0533.16 - Boxes for Electrical Systems: Switch outlets and installation of switch devices.

#### 1.3 REFERENCE STANDARDS

- A. NEMA ICS 4 - Application Guideline for Terminal Blocks; 2015.
- B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

#### 1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data showing dimensions and ratings for compo
- C. Shop Drawings: Indicate wiring diagrams of system, showing interface with branch circuit wiring. Wiring diagrams shall be project specific with all devices clearly labelled.
  - 1. Provide floor plans indicating locations of devices, and wiring with devices clearly labelled.
  - 2. Provide schedules indicating relay grouping, control sequences, and settings.
- D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Project Record Documents: Record actual locations of components and record circuiting and switching arrangements.
- F. Maintenance Data: Include replacement parts numbers.

#### 1.5 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Cooper Controls: Greengate.
- B. Acuity Brand Controls: LC&D or N-Light.
- C. Hubbell Building Automation Systems.
- D. Wattstopper.

### 2.2 PROGRAMMABLE RELAY PANELS

- A. Description: Relay cabinet with power supply, terminal blocks, and logic cards for the specified programming functions.
- B. Relays per Panel: As indicated.
- C. Programming Functions:
  - 1. Multiple Switch Control: More than 1 switch can control each relay.
  - 2. Capable of scene controls (turning scheduled relays on & off with one button as scheduled).
  - 3. Pilot Status Indication: Signal for indicating relay status at remote location.
  - 4. Relay Grouping: Allow relays to be grouped for common control.
  - 5. Scheduling: Allow scheduling of 99 events each capable of switching 1 relay groups according to a programmed time schedule. Allow for up to 12 holidays.
- D. Cabinet: Surface-mounted sheet metal cabinet.
  - 1. Cabinets shall be provided with voltage separation, where required.

### 2.3 REMOTE CONTROL SWITCHING RELAYS

- A. Description: Heavy duty, two-coil momentary contact type remote control relays.
- B. Contacts: Rated 20 amperes at 120 or 277 volts and with isolated and non-isolated pilot contacts where indicated.
- C. Line Voltage Connections: Clamp type screw terminals.

### 2.4 REMOTE SWITCHES

- A. Wall Switch: Toggle type.
  - 1. Description: Momentary contact, three position switches, color to match wiring devices Section 26 2726, rated 3 amperes at 25 VAC.
- B. Switch Plates:
  - 1. See Section 26 2726 - Wiring Devices
- C. Control Stations
  - 1. Multi-button stations with master on/off, as scheduled.
  - 2. Each button shall have factory label indicating loads controlled.
  - 3. Color and cover plate to match wiring devices Section 26 2726.

### 2.5 REMOTE SENSORS

- A. Exterior Lighting Sensor:
  - 1. Description: Photodiode lighting sensor in weatherproof housing.

- B. Interior Lighting Sensor:
  - 1. Description: Photodiode lighting sensor suitable for mounting on wall or ceiling and characterized with a dead band to eliminate ON-OFF cycling of relays in response to its own switching action.
- C. Photocell Control Unit:
  - 1. Photodiode control unit with PHOTOCELL ENABLE and MASTER OVERRIDE inputs for remote control, 3-minute time delay.
  - 2. Selectable ranges for 1 to 10 fc, 10 to 100 fc, 100 to 1000 fc, 1000 to 10,000 fc.

## 2.6 RELAY CABINETS

- A. Boxes: Galvanized steel with removable endwalls.
- B. Interior Panel: Metal, suitable for mounting components, matte white.
- C. Fronts: Steel, surface type with concealed trim clamps door with concealed hinge, and flush lock keyed to match branch circuit panelboard. Finish with gray baked enamel.
- D. Metal Barriers: Between wiring of different systems and voltages.
- E. Power Terminals: NEMA ICS 4, unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.
- F. Signal and Control Terminals: NEMA ICS 4, modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.
- G. Ground Bus Terminal Block: Bond each connector to enclosure.
- H. Power Supply: NFPA 70, Class 2 transformer.

## 2.7 POWER LIMITED WIRE AND CABLE

- A. Remote Control Cable: Copper conductor, 300 volt insulation rated 60 degrees C, individual conductors twisted together and covered with PVC jacket.
- B. Plenum Cable: Copper conductor, 300 volt insulation rated 60 degrees C, individual conductors twisted together and covered with nonmetallic jacket; suitable for use in air handling ducts, hollow spaces used as ducts, and plenums.

# PART 3 EXECUTION

## 3.1 INSTALLATION

- A. Install wiring in the following locations in conduit in accordance with Section 26 0533.13:
  - 1. Within walls.
  - 2. Above inaccessible ceilings.
  - 3. Within hollow spaces used as air handling ducts and plenums.
  - 4. Exposed along surfaces.
- B. Cabling not installed in conduit shall be supported from structure. DO NOT support cabling from duct work, piping, ceiling grid wires, ceiling tiles, etc. Provide plenum rated cable where required.
- C. Install relays to be accessible. Allow space for adequate ventilation and circulation of air.
- D. Provide full system programming and commissioning and verify proper operation of all components and make field adjustments as required. Programming shall be complete prior to final punchlist and owner demonstration.

1. System shall be programmed as indicated on the plans and as directed by the owner. where discrepancies exist contact the engineer.

### 3.2 DEMONSTRATION

- A. System shall be fully programmed and tested by manufacturer representative prior to final punch list and owner demonstration.
- B. Demonstrate proper operation of system to owner and engineer at time of final punchlist. Extra trips to the site required by the engineer and architect for demonstration will be billed to the contractor at standard hourly rates, including any reimbursable expenses such as rental car fees, gas, meals, etc.

### 3.3 OWNER PERSONNEL TRAINING

- A. Provide minimum 4 hours of detailed on-site operation and maintenance instructions and training.
- B. Use submitted Operation and Maintenance manuals as reference during training.

### 3.4 SCHEDULES

- A. As shown on the drawings.

END OF SECTION 26 0918

## SECTION 26 0923 - LIGHTING CONTROL DEVICES

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Occupancy sensors.
- B. Daylighting controls.

#### 1.2 RELATED REQUIREMENTS

- A. Section 26 0526 - Grounding and Bonding.
- B. Section 26 0529 - Hangers and Supports.
- C. Section 260534 - Conduit.
- D. Section 26 0533.16 - Boxes for Electrical Systems.
- E. Section 26 2726 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, and fan speed controllers.
- F. Section 26 5100 - Interior Lighting.

#### 1.3 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.
- C. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2011.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.
- F. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
  - 2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
  - 3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
  - 4. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
  - 5. Notify Engineer of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

- B. Sequencing:
  - 1. Do not install lighting control devices until final surface finishes and painting are complete.

#### 1.5 SUBMITTALS

- A. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
  - 1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.
- B. Shop Drawings:
  - 1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.
  - 2. Daylighting Controls: Provide lighting plan indicating location, model number, and orientation of each photo sensor and associated system component.
- C. Field Quality Control Reports.
- D. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Operation and Maintenance Data: Include detailed information on device programming and setup.
- F. Project Record Documents: Record actual installed locations and settings for lighting control devices.

#### 1.6 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

#### 1.7 DELIVERY, STORAGE, AND PROTECTION

- A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

#### 1.8 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

#### 1.9 WARRANTY

- A. Provide five year manufacturer warranty for all occupancy sensors.

### PART 2 PRODUCTS

#### 2.1 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

- C. Products for Switching of Electronic Ballasts/Drivers: Tested and rated to be suitable for peak inrush currents specified in NEMA 410.

## 2.2 OCCUPANCY SENSORS

### A. Manufacturers:

1. Hubbell Building Automation, Inc: [www.hubbellautomation.com](http://www.hubbellautomation.com)
2. Sensor Switch Inc: [www.sensorswitch.com](http://www.sensorswitch.com).
3. WattStopper: [www.wattstopper.com](http://www.wattstopper.com).
4. Cooper Lighting.
5. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

### B. All Occupancy Sensors:

1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
2. Sensor Technology:
  - a. Passive Infrared (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.
  - b. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.
  - c. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
6. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.
7. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
8. Sensitivity: Field adjustable.
9. Adaptive Technology: Field selectable; capable of self-adjusting sensitivity and time delay according to conditions.
10. Integral Photocell: For field selectable and adjustable inhibition of automatic turn-on of load when ambient lighting is above the selected level.
11. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
12. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on the drawings.
13. Isolated Relay for Low Voltage Occupancy Sensors: SPDT dry contacts, ratings as required for interface with system indicated.

C. Wall Switch Occupancy Sensors:

1. All Wall Switch Occupancy Sensors:
  - a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated manual control capability, and no leakage current to load in off mode.
  - b. Unless otherwise indicated or required to control the load indicated on the drawings, provide line voltage units with self-contained relay.
  - c. Where indicated, provide two-circuit units for control of two separate lighting loads, with separate manual controls and separately programmable operation for each load.
  - d. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).
  - e. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.
  - f. Finish: Match finishes specified for wiring devices in Section 26 2726, unless otherwise indicated.
2. Passive Infrared (PIR) Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.
3. Ultrasonic Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 400 square feet.
4. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.

D. Wall Dimmer Occupancy Sensors:

1. General Requirements:
  - a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated dimming control capability , and no leakage current to load in off mode.
  - b. Dimmer: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, and listed as complying with UL 1472; type and rating suitable for load controlled.

E. Ceiling Mounted Occupancy Sensors:

1. All Ceiling Mounted Occupancy Sensors:
  - a. Description: Low profile occupancy sensors designed for ceiling installation.
  - b. Unless otherwise indicated or required to control the load indicated on the drawings, provide low voltage units, for use with separate compatible accessory power packs.
  - c. Provide field selectable setting for disabling LED motion detector visual indicator.
  - d. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.
  - e. Finish: White unless otherwise indicated.
2. Passive Infrared (PIR) Ceiling Mounted Occupancy Sensors:
  - a. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 15 feet, with a field of view of 360 degrees.



3. Ultrasonic Ceiling Mounted Occupancy Sensors:
    - a. Standard Range Sensors: Capable of detecting motion within an area of 500 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
  4. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:
    - a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
  5. Passive Infrared/Acoustic Dual Technology Ceiling Mounted Occupancy Sensors:
    - a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.
- F. Power Packs for Low Voltage Occupancy Sensors:
1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.
  2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on the drawings.
  3. Input Supply Voltage: Dual rated for 120/277 V ac.
  4. Load Rating: As required to control the load indicated on the drawings.

## 2.3 DAYLIGHTING CONTROLS

- A. System Description: Control system consisting of photo sensors and compatible control modules and power packs, contactors, or relays as required for automatic control of load indicated according to available natural light; capable of integrating with occupancy sensors and manual override controls.
- B. Daylighting Control Photo Sensors: Low voltage class 2 photo sensor units with output signal proportional to the measured light level and provision for zero or offset based signal.
1. Sensor Type: Filtered silicon photo diode.
  2. Sensor Range:
    - a. Indoor Photo Sensors: 5 to 100 footcandles.
- C. Dimming Photo Sensors: Photo sensor units with integral controller compatible with specified dimming ballasts, for direct continuous dimming of up to 50 ballasts.
- D. Daylighting Control Dimming Modules for Low Voltage Sensors: Low voltage class 2 control unit compatible with specified photo sensors and with specified dimming ballasts, for both continuous dimming of compatible dimming ballasts and switching of compatible power packs, contactors, or relays in response to changes in measured light levels according to selected settings.
1. Operation: Unless otherwise indicated, specified load to be continuously brightened as not enough daylight becomes available and continuously dimmed as enough daylight becomes available.
  2. Load to be turned off when available daylight is sufficient to fully dim the load, after the selected time delay.
  3. Control Capability: Capable of controlling up to three separately programmable channels, with up to 50 ballasts per channel.
  4. Dimming and Fade Rates: Adjustable from 5 to 60 seconds.
  5. Cut-Off Delay: Selectable and adjustable from 0 to 20 minutes.

- E. Power Packs for Low Voltage Daylighting Control Modules:
  - 1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage daylighting control modules for switching of line voltage loads. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on the drawings.
  - 2. Input Supply Voltage: Dual rated for 120/277 V ac.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- B. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.
- C. Verify that final surface finishes are complete, including painting.
- D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.
- E. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.
- F. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.2 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

#### 3.3 INSTALLATION

- A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of lighting control devices provided under this section.
  - 1. Mounting Heights: Unless otherwise indicated, as follows:
    - a. Wall Switch Occupancy Sensors: 46 Inches above finished floor.
  - 2. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.
  - 3. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Engineer to obtain direction prior to proceeding with work.
- C. Install lighting control devices in accordance with manufacturer's instructions.
- D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- E. Install lighting control devices plumb and level, and held securely in place.

- F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 2726.
  - G. Provide required supports in accordance with Section 26 0529.
  - H. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
  - I. Occupancy Sensor Locations:
    - 1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.
    - 2. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.
  - J. Daylighting Control Photo Sensor Locations:
    - 1. Unless otherwise indicated, locate photo sensors for closed loop systems to accurately measure the light level controlled at the designated task location, while minimizing the measured amount of direct light from natural or artificial sources such as windows or pendant luminaires.
    - 2. Unless otherwise indicated, locate photo sensors for open loop systems to accurately measure the level of daylight coming into the space, while minimizing the measured amount of lighting from artificial sources.
  - K. Install wiring in the following locations in conduit in accordance with Section 26 0534:
    - 1. Within walls.
    - 2. Above inaccessible ceilings.
    - 3. Within hollow spaces used as air handling ducts and plenums.
    - 4. Exposed along surfaces.
  - L. Cabling not installed in conduit shall be supported from structure. DO NOT support cabling from duct work, piping, ceiling grid wires, ceiling tiles, etc. Provide plenum rated cable where required.
  - M. Lamp Burn-In: Operate lamps at full output for minimum of 100 hours or prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.
  - N. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near the sensor location.
  - O. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.
  - P. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.
- 3.4 FIELD QUALITY CONTROL
- A. Inspect each lighting control device for damage and defects.

- B. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.
- C. Test daylighting controls to verify proper operation, including light level measurements and time delays where applicable. Record test results in written report to be included with submittals.
- D. Correct wiring deficiencies and replace damaged or defective lighting control devices.

### 3.5 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Engineer.
- C. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block undesired motion detection.
- D. Adjust daylighting controls under optimum lighting conditions after all room finishes, furniture, and window treatments have been installed to achieve desired operation as indicated or as directed by Architect. Record settings in written report to be included with submittals. Readjust controls calibrated prior to installation of final room finishes, furniture, and window treatments that do not function properly as determined by Engineer.

### 3.6 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

### 3.7 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate proper operation of lighting control devices to Engineer, and correct deficiencies or make adjustments as directed.
- B. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.
  - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
  - 2. Provide minimum of two hours of training.
  - 3. Location: At project site.

END OF SECTION 26 0923

## SECTION 26 2100 - ELECTRICAL SERVICE ENTRANCE

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Electrical service requirements.

#### 1.2 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Materials and installation requirements for cast-in-place concrete equipment pads.
- B. Section 26 0519 - Conductors and Cables.
- C. Section 26 0526 - Grounding and Bonding.
- D. Section 26 0529 - Hangers and Supports.
- E. Section 26 0533.13 - Conduit for Electrical Systems.
- F. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- G. Section 26 2416 - Panelboards: Service entrance equipment.
- H. Section 26 2816.16 - Enclosed Switches: Service entrance equipment.

#### 1.3 DEFINITIONS

- A. Service Point: The point of connection between the facilities of the serving utility and the premises wiring as defined in NFPA 70, and as designated by the Utility Company.

#### 1.4 REFERENCE STANDARDS

- A. IEEE C2 - National Electrical Safety Code; 2012.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

#### 1.5 ADMINISTRATIVE REQUIREMENTS

- A. No later than two weeks following date of the Agreement, notify Utility Company of anticipated date of service.
- B. Coordination:
  - 1. Verify the following with Utility Company representative:
    - a. Utility Company requirements, including division of responsibility.
    - b. Exact location and details of utility point of connection.
    - c. Utility easement requirements.
    - d. Utility Company charges associated with providing service.
  - 2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for electrical service and associated equipment.
  - 3. Coordinate arrangement of service entrance equipment with the dimensions and clearance requirements of the actual equipment to be installed.

4. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
- C. Arrange for Utility Company to provide permanent electrical service. Prepare and submit documentation required by Utility Company.
- D. Utility Company charges associated with providing permanent service to be paid by Owner.
- E. Preinstallation Meeting: Convene one week prior to commencing work of this section to review service requirements and details with Utility Company representative.
- F. Scheduling:
  1. Where work of this section involves interruption of existing electrical service, arrange service interruption with Owner.
  2. Arrange for inspections necessary to obtain Utility Company approval of installation.

## 1.6 QUALITY ASSURANCE

- A. Comply with the following:
  1. IEEE C2 (National Electrical Safety Code).
  2. NFPA 70 (National Electrical Code).
  3. The requirements of the Utility Company.
  4. The requirements of the local authorities having jurisdiction.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

## PART 2 PRODUCTS

### 2.1 ELECTRICAL SERVICE REQUIREMENTS

- A. Provide new electrical service consisting of all required conduits, conductors, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment.
- B. Electrical Service Characteristics: As indicated on drawings.
- C. Utility Company: MidAmerican Energy.
  1. Point of Contact: David Fitch.
  2. Phone: 712-366-5669.
- D. Division of Responsibility: As indicated on drawings.
- E. Products Furnished by Contractor: Comply with Utility Company requirements.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that ratings and configurations of service entrance equipment are consistent with the indicated requirements.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

- A. Verify and mark locations of existing underground utilities.

3.3 INSTALLATION

- A. Install products in accordance with manufacturer's instructions and Utility Company requirements.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances and required maintenance access.
- D. Bond all metallic meter enclosures and CT cabinets to the building grounding system. Size secondary conduits to accommodate bonding conductors.
- E. Construct cast-in-place concrete pads for utility equipment in accordance with Utility Company requirements and Section 03 3000.
- F. Provide required protective bollards in accordance with Utility Company requirements.
- G. Provide required support and attachment components in accordance with Section 26 0529.
- H. Provide grounding and bonding for service entrance equipment in accordance with Section 26 0526.
- I. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 26 0553.

3.4 PROTECTION

- A. Protect installed equipment from subsequent construction operations.

END OF SECTION 26 2100

## SECTION 26 2416 - PANELBOARDS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Power distribution panelboards.
- B. Lighting and appliance panelboards.
- C. Overcurrent protective devices for panelboards.

#### 1.2 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 26 0526 - Grounding and Bonding.
- C. Section 26 0529 - Hangers and Supports.
- D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

#### 1.3 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; Federal Specification; Revision E, 2013.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2009.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- E. NEMA PB 1 - Panelboards; 2011.
- F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; 2013.
- G. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.
- H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- K. UL 67 - Panelboards; Current Edition, Including All Revisions.
- L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.
- M. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.



#### 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
  - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
  - 3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
  - 4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
  - 5. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

#### 1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.
  - 1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
  - 1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
  - 2. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
- D. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as routine tests.
- E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- F. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.
- G. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

#### 1.6 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Eaton Corporation: [www.eaton.com](http://www.eaton.com).
- B. General Electric Company: [www.geindustrial.com](http://www.geindustrial.com).
- C. Schneider Electric; Square D Products: [www.schneider-electric.us](http://www.schneider-electric.us).
- D. Siemens Industry, Inc: [www.usa.siemens.com](http://www.usa.siemens.com).
- E. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

### 2.2 PANELBOARDS - GENERAL REQUIREMENTS

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
  - 1. Altitude: Less than 6,600 feet.
  - 2. Ambient Temperature:
    - a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.
- C. Short Circuit Current Rating:
  - 1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
  - 2. Listed series ratings are not acceptable.
- D. Panelboards Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.
- E. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.
- F. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.
- G. Bussing: Sized in accordance with UL 67 temperature rise requirements.
  - 1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
  - 2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
- H. Conductor Terminations: Suitable for use with the conductors to be installed.
- I. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: Type 1.
    - b. Outdoor Locations: Type 3R.
  2. Boxes: Galvanized steel unless otherwise indicated.
    - a. Provide wiring gutters sized to accommodate the conductors to be installed.
  3. Fronts:
    - a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
    - b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
  4. Lockable Doors: All locks keyed alike unless otherwise indicated.
- J. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
- K. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.
- L. Load centers are not acceptable.
- M. Provide the following features and accessories where indicated or where required to complete installation:
1. Feed-through lugs.
  2. Sub-feed lugs.
- ### 2.3 POWER DISTRIBUTION PANELBOARDS
- A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.
- B. Products:
1. Square D: I-Line, or equal.
- C. Conductor Terminations:
1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
  2. Main and Neutral Lug Type: Mechanical.
- D. Bussing:
1. Phase and Neutral Bus Material: Copper.
  2. Ground Bus Material: Copper.
- E. Circuit Breakers:
1. Provide bolt-on type.
  2. Provide thermal magnetic circuit breakers unless otherwise indicated.
  3. Provide electronic trip circuit breakers where indicated.
- F. Enclosures:
1. Provide surface-mounted enclosures unless otherwise indicated.
  2. Fronts: Provide trims to cover access to load terminals, wiring gutters, and other live parts, with exposed access to overcurrent protective device handles.
- ### 2.4 LIGHTING AND APPLIANCE PANELBOARDS
- A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

- B. Conductor Terminations:
  - 1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
  - 2. Main and Neutral Lug Type: Mechanical.
- C. Bussing:
  - 1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
  - 2. Phase and Neutral Bus Material: Aluminum or copper.
  - 3. Ground Bus Material: Aluminum or copper.
- D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.
- E. Enclosures:
  - 1. Provide surface-mounted or flush-mounted enclosures as indicated.
  - 2. Fronts: Provide door-in-door trim with hinged cover to box for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts. Outer door is to be bolted.
  - 3. Provide clear plastic circuit directory holder mounted on inside of door.

## 2.5 OVERCURRENT PROTECTIVE DEVICES

- A. Molded Case Circuit Breakers:
  - 1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
  - 2. Interrupting Capacity:
    - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
      - 1) 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
    - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
  - 3. Conductor Terminations:
    - a. Provide mechanical lugs unless otherwise indicated.
    - b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
  - 4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
    - a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
    - b. Provide interchangeable trip units where indicated.
  - 5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
    - a. Provide the following field-adjustable trip response settings:
      - 1) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
      - 2) Long time delay.
      - 3) Short time pickup and delay.
      - 4) Instantaneous pickup.
      - 5) Ground fault pickup and delay where ground fault protection is indicated.

6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
7. Do not use tandem circuit breakers.
8. Do not use handle ties in lieu of multi-pole circuit breakers.
9. Provide multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
10. Provide the following features and accessories where indicated or where required to complete installation:
  - a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
  - b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.
  - c. Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.

## 2.6 SOURCE QUALITY CONTROL

- A. Factory test panelboards according to NEMA PB 1.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
- B. Verify that mounting surfaces are ready to receive panelboards.
- C. Verify that conditions are satisfactory for installation prior to starting work.

### 3.2 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.
- D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- E. Provide required supports in accordance with Section 26 0529.
- F. Install panelboards plumb.
- G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.
- H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.
- I. Mount floor-mounted power distribution panelboards on properly sized 3 inch high concrete pad constructed in accordance with Section 03 3000.
- J. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.
- K. Provide grounding and bonding in accordance with Section 26 0526.
- L. Install all field-installed branch devices, components, and accessories.

- M. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.
- N. Set field-adjustable circuit breaker tripping function settings as directed.
- O. Provide filler plates to cover unused spaces in panelboards.
- P. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:
  - 1. Fire detection and alarm circuits.

### 3.3 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
- D. Test shunt trips to verify proper operation.
- E. Correct deficiencies and replace damaged or defective panelboards or associated components.

### 3.4 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of panelboard fronts.
- C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

### 3.5 CLEANING

- A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 2416

## SECTION 26 2726 - WIRING DEVICES

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Wall switches.
- B. Wall dimmers.
- C. Receptacles.
- D. Wall plates.
- E. Floor box service fittings.
- F. Poke-through assemblies.

#### 1.2 RELATED REQUIREMENTS

- A. Section 26 0519 - Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.
- B. Section 26 0526 - Grounding and Bonding.
- C. Section 26 0533.16 - Boxes for Electrical Systems.
- D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 0923 - Lighting Control Devices: Devices for automatic control of lighting, including occupancy sensors.
- F. Section 27 1005 - Structured Cabling for Voice and Data: Voice and data jacks.

#### 1.3 REFERENCE STANDARDS

- A. FS W-C-596 - Connector, Electrical, Power, General Specification for; Federal Specification; Revision G, 2001.
- B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); Federal Specification; Revision F, 1999.
- C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.
- E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R 2010).
- F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2012.
- G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 20 - General-Use Snap Switches; Current Edition, Including All Revisions.
- I. UL 498 - Attachment Plugs and Receptacles; Current Edition, Including All Revisions.
- J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices; Current Edition, Including All Revisions.
- K. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

- L. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

##### A. Coordination:

1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
5. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
6. Notify Engineer of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

##### B. Sequencing:

1. Do not install wiring devices until final surface finishes and painting are complete.

#### 1.5 SUBMITTALS

##### A. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1. Wall Dimmers: Include derating information for ganged multiple devices.

##### B. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

##### C. Operation and Maintenance Data:

1. Wall Dimmers: Include information on operation and setting of presets.
2. GFCI Receptacles: Include information on status indicators.

#### 1.6 QUALITY ASSURANCE

##### A. Conform to requirements of NFPA 70.

##### B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

##### C. Products: Listed, classified, and labeled as suitable for the purpose intended.

#### 1.7 DELIVERY, STORAGE, AND PROTECTION

##### A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

### PART 2 PRODUCTS

#### 2.1 WIRING DEVICE APPLICATIONS

##### A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

##### B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.



- C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.
- D. Provide GFI protection for all receptacles installed within 6 feet of sinks and other locations as required by the NEC.
- E. Provide GFCI protection for receptacles installed in kitchens.
- F. Provide GFCI protection for receptacles serving electric drinking fountains.
- G. For flush floor service fittings, use carpet flanges for installations in carpeted floors.

## 2.2 WIRING DEVICE FINISHES

- A. Provide wiring device finishes as described below unless otherwise indicated.
- B. Wiring Devices, Unless Otherwise Indicated: White with white nylon wall plate.
- C. Wiring Devices Installed in Wet or Damp Locations: Gray with specified weatherproof cover.
- D. Flush Floor Box Service Fittings: Black wiring devices with Black cover and ring/flange.
- E. Flush Poke-Through Service Fittings: Black wiring devices with Black cover and flange.

## 2.3 WALL SWITCHES

- A. Manufacturers:
  - 1. Hubbell Incorporated: [www.hubbell-wiring.com](http://www.hubbell-wiring.com).
  - 2. Leviton Manufacturing Company, Inc: [www.leviton.com](http://www.leviton.com).
  - 3. Pass & Seymour, a brand of Legrand North America, Inc: [www.legrand.us](http://www.legrand.us)
- B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.
  - 1. Wiring Provisions: Terminal screws for side wiring with separate ground terminal screw.
- C. Standard Wall Switches: Commercial specification grade, 20 A, 120/277 V with decorator style rocker type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

## 2.4 WALL DIMMERS

- A. Manufacturers:
  - 1. Leviton Manufacturing Company, Inc: [www.leviton.com](http://www.leviton.com).
  - 2. Lutron Electronics Company, Inc: [www.lutron.com/sle](http://www.lutron.com/sle).
  - 3. Pass & Seymour, a brand of Legrand North America, Inc: [www.legrand.us](http://www.legrand.us)
- B. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.
- C. Control: Slide control type with separate on/off switch.

- D. Power Rating, Unless Otherwise Indicated or Required to Control the Load Indicated on the Drawings:
  - 1. LED Lighting
- E. Provide accessory wall switches to match dimmer appearance when installed adjacent to each other.

## 2.5 RECEPTACLES

- A. Manufacturers:
  - 1. Hubbell Incorporated: [www.hubbell-wiring.com](http://www.hubbell-wiring.com).
  - 2. Leviton Manufacturing Company, Inc.: [www.leviton.com](http://www.leviton.com).
  - 3. Pass & Seymour, a brand of Legrand North America, Inc.: [www.legrand.us](http://www.legrand.us)
- B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
  - 1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
  - 2. NEMA configurations specified are according to NEMA WD 6.
- C. Convenience Receptacles:
  - 1. Standard Convenience Receptacles: Commercial specification grade, 20A, 125V, NEMA 5-20R, rectangular decorator style; single or duplex as indicated on the drawings.
  - 2. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
- D. GFCI Receptacles:
  - 1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
    - a. Provide test and reset buttons of same color as device.
  - 2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
  - 3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

## 2.6 WALL PLATES

- A. Manufacturers:
  - 1. Hubbell Incorporated: [www.hubbell-wiring.com](http://www.hubbell-wiring.com).
  - 2. Leviton Manufacturing Company, Inc.: [www.leviton.com](http://www.leviton.com).
  - 3. Pass & Seymour, a brand of Legrand North America, Inc.: [www.legrand.us](http://www.legrand.us).
- B. Wall Plates: Comply with UL 514D.
  - 1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
  - 2. Size: Standard.
  - 3. Screws: Metal with slotted heads finished to match wall plate finish.
- C. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.

- D. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.
- E. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.
- F. Weatherproof Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.
- G. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

## 2.7 FLOOR BOX SERVICE FITTINGS

- A. Manufacturers:
  - 1. Hubbell Incorporated: [www.hubbell-wiring.com](http://www.hubbell-wiring.com).
  - 2. Wiremold, a brand of Legrand North America, Inc: [www.legrand.us](http://www.legrand.us)
- B. Description: Service fittings compatible with floor boxes provided under Section 26 0533.16 with components, adapters, and trims required for complete installation.
- C. Flush Floor Service Fittings:
  - 1. Single Service Flush Convenience Receptacles:
    - a. Cover: Round.
    - b. Configuration: One standard convenience duplex receptacle(s) with rectangular decorator style flap opening(s).
  - 2. Single Service Flush Communications Outlets:
    - a. Cover: Round.
    - b. Configuration: As indicated on Plans.
  - 3. Dual Service Flush Combination Outlets:
    - a. Cover: Rectangular.
    - b. Configuration:
      - 1) Power: Two standard convenience duplex receptacle(s) with duplex flap opening(s).
      - 2) Communications: Provide required communications brackets and faceplates.
      - 3) Voice and Data Jacks: As specified in Section 27 1005.
  - 4. Accessories:
    - a. Tile Rings: Finish to match covers; configuration as required to accommodate specified covers.
    - b. Carpet Flanges: Finish to match covers; configuration as required to accommodate specified covers.

## 2.8 POKE-THROUGH ASSEMBLIES

- A. Manufacturers:
  - 1. Hubbell Incorporated: [www.hubbell-wiring.com](http://www.hubbell-wiring.com).
  - 2. Wiremold, a brand of Legrand North America, Inc: [www.legrand.us](http://www.legrand.us).
- B. Description: Assembly comprising floor service fitting, poke-through component, fire stops and smoke barriers, and junction box for conduit termination; fire rating listed to match fire rating of floor and suitable for floor thickness where installed.
- C. Flush Floor Service Fittings:
  - 1. Single Service Flush Convenience Receptacles:

- a. Configuration: One standard convenience duplex receptacle(s) with duplex flap opening(s).
- 2. Single Service Flush Communications Outlets:
  - a. Voice and Data Jacks: As specified in Section 27 1005.
- 3. Dual Service Flush Combination Outlets:
  - a. Cover: Hinged door(s).
  - b. Configuration:
    - 1) Power: Two standard convenience duplex receptacle(s).
    - 2) Voice and Data Jacks: As specified in Section 27 1005.
- 4. Accessories:
  - a. Closure Plugs: Size and fire rating as required to seal unused core hole and maintain fire rating of floor.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Install hospital grade receptacles in all patient care areas, standard grade receptacles in other areas.
- B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.
- C. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- D. Verify that final surface finishes are complete, including painting.
- E. Verify that floor boxes are adjusted properly.
- F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- G. Verify that core drilled holes for poke-through assemblies are in proper locations.
- H. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.2 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

#### 3.3 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of wiring devices provided under this section.
  - 1. Mounting Heights: Unless otherwise indicated, as follows:
    - a. Wall Switches: 46 inches above finished floor.
    - b. Wall Dimmers: 46 inches above finished floor.
    - c. Receptacles: 18 inches above finished floor or 4 inches above top of counter/backsplash.
    - d. Voice and Data Outlets: 18 inches above finished floor or 4 inches above top of counter/backsplash..

2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
  3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate. Provide voltage separation as required.
  4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Engineer to obtain direction prior to proceeding with work.
  5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions. Ground fault device shall be installed in an accessible location.
- C. Install wiring devices in accordance with manufacturer's instructions.
  - D. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.
  - E. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
  - F. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
  - G. Unless otherwise indicated, GFCI receptacles may be connected to provide feed-through protection to downstream devices. Label such devices to indicate they are protected by upstream GFCI protection.
  - H. Install wiring devices plumb and level with mounting yoke held rigidly in place.
  - I. Install wall switches with OFF position down.
  - J. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.
  - K. Do not share neutral conductor on branch circuits utilizing wall dimmers.
  - L. Where required by wall dimmer manufacturer provide separate conduit for 0-10V control conductors.
  - M. Install vertically mounted receptacles with grounding pole on bottom and horizontally mounted receptacles with grounding pole on left.
  - N. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.
  - O. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.
  - P. Install poke-through closure plugs in each unused core holes to maintain fire rating of floor.
- 3.4 FIELD QUALITY CONTROL
- A. See Section 01 4000 - Quality Requirements, for additional requirements.
  - B. Inspect each wiring device for damage and defects.

- C. Operate each wall switch and wall dimmer with circuit energized to verify proper operation.
- D. Test each receptacle to verify operation and proper polarity.
- E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.
- F. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.5 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.

3.6 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION 26 2726

## SECTION 26 2813 - FUSES

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Fuses.

#### 1.2 RELATED REQUIREMENTS

- A. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- B. Section 26 2816.16 - Enclosed Switches: Fusible switches.
- C. Section 26 2913 - Enclosed Controllers: Fusible switches.

#### 1.3 REFERENCE STANDARDS

- A. NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.
- B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.
- D. UL 248-4 - Low-Voltage Fuses - Part 4: Class CC Fuses; Current Edition, Including All Revisions.
- E. UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses; Current Edition, Including All Revisions.
- F. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
    - a. Fusible Enclosed Switches: See Section 26 2816.16.
    - b. Fusible Switches for Enclosed Motor Controllers: See Section 26 2913.
  - 2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
  - 3. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

#### 1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 6000 - Product Requirements, for additional provisions.
  - 2. Extra Fuses: One set(s) of three for each type and size installed.

#### 1.6 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Bussmann, a division of Eaton Corporation: [www.cooperindustries.com](http://www.cooperindustries.com).

- B. Littelfuse, Inc: [www.littelfuse.com](http://www.littelfuse.com).

## 2.2 APPLICATIONS

- A. Feeders:
  - 1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
  - 2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.
- B. General Purpose Branch Circuits: Class RK1, time-delay.
- C. Individual Motor Branch Circuits: Class RK1, time-delay.
- D. Primary Protection for Control Transformers: Class CC, time-delay.

## 2.3 FUSES

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.
- C. Provide fuses of the same type, rating, and manufacturer within the same switch.
- D. Comply with UL 248-1.
- E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.
- F. Voltage Rating: Suitable for circuit voltage.
- G. Class R Fuses: Comply with UL 248-12.
  - 1. Class RK1, Time-Delay Fuses:
- H. Class L Fuses: Comply with UL 248-10.
- I. Class CC Fuses: Comply with UL 248-4.
- J. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.
- K. Provide the following accessories where indicated or where required to complete installation:
  - 1. Fuseholders: Compatible with indicated fuses.
  - 2. Fuse Reducers: For adapting indicated fuses to permit installation in switch designed for fuses with larger ampere ratings.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.
- B. Verify that conditions are satisfactory for installation prior to starting work.

### 3.2 INSTALLATION

- A. Do not install fuses until circuits are ready to be energized.
- B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION 26 2813



## SECTION 26 2816.16 - ENCLOSED SWITCHES

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Enclosed safety switches.

#### 1.2 RELATED REQUIREMENTS

- A. Section 26 0526 - Grounding and Bonding.
- B. Section 26 0529 - Hangers and Supports.
- C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 2813 - Fuses.
- E. Section 26 2913 - Enclosed Controllers: Manual motor controllers.

#### 1.3 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2014.
- C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- F. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- G. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
  - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
  - 3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
  - 4. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

#### 1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

- C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
- D. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

#### 1.6 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Eaton Corporation: [www.eaton.com](http://www.eaton.com).
- B. General Electric Company: [www.geindustrial.com](http://www.geindustrial.com).
- C. Schneider Electric; Square D Products: [www.schneider-electric.us](http://www.schneider-electric.us).
- D. Siemens Industry, Inc: [www.usa.siemens.com](http://www.usa.siemens.com).
- E. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

#### 2.2 ENCLOSED SAFETY SWITCHES

- A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Horsepower Rating: Suitable for connected load.
- D. Voltage Rating: Suitable for circuit voltage.
- E. Short Circuit Current Rating:
  - 1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
  - 2. Minimum Ratings:
    - a. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.
- F. Provide with switch blade contact position that is visible when the cover is open.
- G. Fuse Clips for Fusible Switches: As required to accept fuses indicated.

1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.
- H. Conductor Terminations: Suitable for use with the conductors to be installed.
- I. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.
- J. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.
- K. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
  1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    - a. Indoor Clean, Dry Locations: Type 1.
    - b. Outdoor Locations: Type 3R.
  2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.
- L. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
- M. Heavy Duty Switches:
  1. Comply with NEMA KS 1.
  2. Conductor Terminations:
    - a. Provide mechanical lugs unless otherwise indicated.
    - b. Lug Material: Copper, suitable for terminating copper conductors only.
  3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.
- N. Provide the following features and accessories where indicated or where required to complete installation:
  1. Hubs: As required for environment type; sized to accept conduits to be installed.
  2. Auxiliary Switch: SPDT switch suitable for connection to system indicated, with auxiliary contact operation before switch blades open and after switch blades close.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.
- B. Verify that mounting surfaces are ready to receive enclosed safety switches.
- C. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required supports in accordance with Section 26 0529.

- E. Install enclosed switches plumb.
- F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.
- G. Provide grounding and bonding in accordance with Section 26 0526.
- H. Provide fuses complying with Section 26 2813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.
- I. Provide an identifying nameplate describing what load the disconnect serves for each disconnect regardless of load location.

### 3.3 FIELD QUALITY CONTROL

- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

### 3.4 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

### 3.5 CLEANING

- A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 26 2816.16

## SECTION 26 2913 - ENCLOSED CONTROLLERS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Manual motor controllers.
- B. Combination Magnetic motor controllers with disconnect.

#### 1.2 RELATED REQUIREMENTS

- A. Section 26 0529 - Hangers and Supports for Electrical Systems.
- B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.
- C. Section 26 2813 - Fuses.

#### 1.3 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- B. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC; National Electrical Manufacturers Association; 2000 (R2005).
- C. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices; National Electrical Manufacturers Association; 2000 (R2010).
- D. NEMA ICS 6 - Industrial Control and Systems: Enclosures; National Electrical Manufacturers Association; 1993 (R2006).
- E. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association; 2001 (R2006).
- F. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association; 2009.
- G. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

#### 1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.
- C. Maintenance Data: Replacement parts list for controllers.

#### 1.5 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Eaton Corporation; Cutler-Hammer Product: [www.eaton.com](http://www.eaton.com).
- B. General Electric Company: [www.geindustrial.com](http://www.geindustrial.com).
- C. Schneider Electric; Square D Products: [www.schneider-electric.us](http://www.schneider-electric.us).
- D. Siemens.

### 2.2 MANUAL CONTROLLERS

- A. Fractional Horsepower Manual Controllers: NEMA ICS 2, AC general-purpose, Class A, manually operated, full-voltage controller for fractional horsepower induction motors, with thermal overload unit and toggle operator.
- B. Motor Starting Switches: NEMA ICS 2, AC general-purpose Class A manually operated, full-voltage controller for fractional horsepower induction motors, without thermal overload unit, with toggle operator.
- C. Enclosures: NEMA ICS 6, Type 1, unless noted otherwise on the drawings.

### 2.3 COMBINATION MAGNETIC MOTOR CONTROLLERS WITH DISCONNECT

- A. All automatic motor starters shall contain only a solid-state overload relay. This overload relay shall provide overload, phase unbalance and phase loss protection using current sensing with a trip class of 20. Solid-state overload relay shall be Square "D" Motor Logic series or approved equal.
- B. Bimetallic or melting alloy type overload relays shall not be used.
- C. All motor starters shall have auto/off/hand selector switch. Motor starter shall not be used as a fire alarm shut down relay. Separate fire alarm relays shall be provided as part of the fire alarm system.
- D. Coil control voltage required shall be verified with Mechanical Contractor for interconnection with the Energy Management System.
- E. Provide enclosure suitable for the environment the starter is installed.
- F. Fuse disconnect switch.

### 2.4 ACCESSORIES

- A. Auxiliary Contacts: NEMA ICS 2, 2 field convertible contacts in addition to seal-in contact.
- B. Cover Mounted Pilot Devices: NEMA ICS 5, standard duty oil-tight type.
- C. Pushbuttons: Unguarded type.
- D. Indicating Lights: Transformer, incandescent type.
- E. Selector Switches: Rotary type.
- F. Relays: NEMA ICS 2.
- G. Control Power Transformers: 120 volt secondary, as scheduled, or as recommended by manufacturer if not scheduled. Provide fused primary, secondary, and bond unfused leg of secondary to enclosure.

## 2.5 DISCONNECTS

- A. Combination Controllers: Combine motor controllers with disconnects in common enclosure. Obtain IEC Class 2 coordinated component protection.
- B. Fusible Switch Assemblies: NEMA KS 1, enclosed knife switch with externally operable handle. Fuse clips: Designed to accommodate Class R fuses.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install enclosed controllers where indicated, in accordance with manufacturer's instructions.
- B. Install securely, in a neat and workmanlike manner, as specified in NECA 1.
- C. Provide supports in accordance with Section 26 0529.
- D. Height: 6 ft to operating handle.
- E. Provide fuses for fusible switches; refer to Section 26 2813 for product requirements.
- F. Provide engraved plastic nameplates; refer to Section 26 0553 for product requirements and location.
- G. Neatly type label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating. Place label in clear plastic holder.
- H. Provide an identifying nameplate on the exterior of enclosure describing what load the disconnect serves for each disconnect regardless of load location.

### 3.2 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01 4000.
- B. Inspect and test in accordance with NETA STD ATS, except Section 4.
- C. Perform inspections and tests listed in NETA STD ATS, Section 7.16.1.

END OF SECTION 26 2913

## SECTION 26 5100 - INTERIOR LIGHTING

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Interior luminaires.
- B. Emergency lighting units.
- C. Exit signs.
- D. Ballasts and drivers.
- E. Fluorescent emergency power supply units.
- F. Lamps.
- G. Luminaire accessories.

#### 1.2 RELATED REQUIREMENTS

- A. Section 26 0533.16 - Boxes for Electrical Systems.
- B. Section 26 0923 - Lighting Control Devices: Automatic controls for lighting including occupancy sensors, outdoor motion sensors, time switches, outdoor photo controls, and daylighting controls.
- C. Section 26 2726 - Wiring Devices: Manual wall switches and wall dimmers.
- D. Section 26 5600 - Exterior Lighting.

#### 1.3 REFERENCE STANDARDS

- A. ANSI C82.11 - American National Standard for Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts - Supplements; 2011.
- B. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).
- C. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; 2008.
- D. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; Illuminating Engineering Society; 2015.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- F. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2006.
- G. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012.
- H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. NFPA 101 - Life Safety Code; 2015.
- J. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.
- K. UL 935 - Fluorescent-Lamp Ballasts; Current Edition, Including All Revisions.



- L. UL 1598 - Luminaires; Current Edition, Including All Revisions.
- M. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
  - 2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
  - 3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
  - 4. Notify Engineer of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

#### 1.5 SUBMITTALS

- A. Shop Drawings:
  - 1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.
  - 1. LED Luminaires:
    - a. Include estimated useful life, calculated based on IES LM-80 test data.
  - 2. Provide electronic files of photometric data certified by an independent testing agency in IESNA LM-63 standard format upon request.
  - 3. Ballasts: Include wiring diagrams and list of compatible lamp configurations.
  - 4. Lamps: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.
  - 5. Fluorescent Emergency Power Supply Unit: Include list of compatible lamp configurations and associated lumen output.
- C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- D. Operation and Maintenance Data: Instructions for each product including information on replacement parts.
- E. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

#### 1.6 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

## 1.7 DELIVERY, STORAGE, AND PROTECTION

- A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

## 1.8 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

## PART 2 PRODUCTS

### 2.1 LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.
- B. Substitutions: See Section 01 6000 - Product Requirements, except where individual luminaire types are designated with substitutions not permitted.

### 2.2 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.
- D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.
- F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- G. Recessed Luminaires:
  - 1. Ceiling Compatibility: Comply with NEMA LE 4.
  - 2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
- H. LED Luminaires:
  - 1. Components: UL 8750 recognized or listed as applicable.
  - 2. Tested in accordance with IES LM-79 and IES LM-80.
  - 3. LED Estimated Useful Life: Minimum of 50,000 hours at 80 percent lumen maintenance, calculated based on IES LM-80 test data.
- I. LED Tape Lighting Systems: Provide all power supplies, drivers, cables, connectors, channels, covers, mounting accessories, and interfaces as necessary to complete installation.
  - 1. LED Tape - General Requirements:
    - a. Listed.
    - b. Designed for field cutting in accordance with listing.

- J. LED Luminaire Components: UL 8750 recognized or listed as applicable.
- K. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

## 2.3 EMERGENCY LIGHTING UNITS

- A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
- B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.
- C. Battery:
  - 1. Size battery to supply all connected lamps, including emergency remote heads where indicated.
- D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.
- E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

## 2.4 EXIT SIGNS

- A. Description: Exit signs and similar signs for special purpose applications such as area of refuge/rescue assistance.
- B. Description: Internally illuminated exit signs with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.
  - 1. Number of Faces: Single or double as indicated or as required for the installed location.
  - 2. Directional Arrows: As indicated or as required for the installed location.

## 2.5 BALLASTS AND DRIVERS

- A. Manufacturers:
  - 1. General Electric Company/GE Lighting: [www.gelighting.com](http://www.gelighting.com).
  - 2. Osram Sylvania: [www.sylvania.com](http://www.sylvania.com).
  - 3. Manufacturer Limitations: Where possible, for each type of luminaire provide ballasts produced by a single manufacturer.
- B. Ballasts/Drivers - General Requirements:
  - 1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
  - 2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.
- C. Dimmable LED Drivers:
  - 1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.
  - 2. Control Compatibility: Fully compatible with the dimming controls to be installed.
    - a. Wall Dimmers: See Section 26 2726.
    - b. Daylighting Controls: See Section 26 0923.

## 2.6 LAMPS

- A. Manufacturers:
  - 1. General Electric Company/GE Lighting: [www.gelighting.com](http://www.gelighting.com).
  - 2. Osram Sylvania: [www.sylvania.com](http://www.sylvania.com).
  - 3. Substitutions: See Section 01 6000 - Product Requirements.
  - 4. Manufacturer Limitations: Where possible, provide lamps produced by a single manufacturer.
- B. Lamps - General Requirements:
  - 1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
  - 2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
  - 3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
  - 4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Engineer to be inconsistent in perceived color temperature.

## 2.7 ACCESSORIES

- A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.
- B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.
- C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- B. Verify that suitable support frames are installed where required.
- C. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- D. Verify that conditions are satisfactory for installation prior to starting work.

### 3.2 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

### 3.3 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install products in accordance with manufacturer's instructions.

- D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).
- E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- F. Suspended Ceiling Mounted Luminaires:
  - 1. Do not use ceiling tiles to bear weight of luminaires.
  - 2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
  - 3. Secure surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
  - 4. Secure pendant-mounted luminaires to building structure.
  - 5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
  - 6. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gage, connected from opposing corners of each recessed luminaire to building structure.
  - 7. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.
- G. Recessed Luminaires:
  - 1. Install trims tight to mounting surface with no visible light leakage.
  - 2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
  - 3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
- H. Suspended Luminaires:
  - 1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
  - 2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
  - 3. Install canopies tight to mounting surface.
  - 4. Unless otherwise indicated, support pendants from swivel hangers.
- I. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
- J. Install accessories furnished with each luminaire.
- K. Bond products and metal accessories to branch circuit equipment grounding conductor.
- L. Emergency Lighting Units:
  - 1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
- M. Exit Signs:
  - 1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.
- N. Remote Ballasts and Drivers: Install in accessible location as indicated or as required to complete installation, using conductors per manufacturer's recommendations not exceeding manufacturer's recommended maximum conductor length to luminaire.

- O. Lamp Burn-In: Operate lamps at full output for a minimum 100hrs or prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

#### 3.4 FIELD QUALITY CONTROL

- A. Inspect each product for damage and defects.
- B. Operate each luminaire after installation and connection to verify proper operation.
- C. Test self-powered exit signs and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.
- D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Engineer.

#### 3.5 ADJUSTING

- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Engineer. Secure locking fittings in place.
- B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Engineer or authority having jurisdiction.
- C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Engineer or authority having jurisdiction.

#### 3.6 CLEANING

- A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

#### 3.7 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate proper operation of luminaires to Engineer, and correct deficiencies or make adjustments as directed.
- B. Just prior to Substantial Completion, replace all lamps that have failed.

#### 3.8 PROTECTION

- A. Protect installed luminaires from subsequent construction operations.

END OF SECTION 26 5100

## SECTION 26 5600 - EXTERIOR LIGHTING

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Exterior luminaires.
- B. Ballasts.
- C. Poles and accessories.

#### 1.2 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Materials and installation requirements for concrete bases for poles.
- B. Section 26 0526 - Grounding and Bonding.
- C. Section 26 0533.16 - Boxes for Electrical Systems.
- D. Section 26 5100 - Interior Lighting.

#### 1.3 REFERENCE STANDARDS

- A. AASHTO LTS - Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals; American Association of State Highway and Transportation Officials; 6th Edition, with 2015 Interim Revisions.
- B. ANSI C82.4 - American National Standard for Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type); 2002.
- C. IEEE C2 - National Electrical Safety Code; 2012.
- D. IESNA LM-63 - ANSI Approved Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).
- E. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; 2008.
- F. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; Illuminating Engineering Society; 2015.
- G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.
- H. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 2006.
- I. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012.
- J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. UL 1598 - Luminaires; Current Edition, Including All Revisions.
- L. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:

1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.
2. Notify Engineer of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

#### 1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
  1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
- C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.
  1. LED Luminaires:
    - a. Include estimated useful life, calculated based on IES LM-80 test data.
    - b. Include IES LM-79 test report upon request.
  2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IESNA LM-63 standard format upon request.
  3. Poles: Include information on maximum supported effective projected area (EPA) and weight for the design wind speed.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

#### 1.6 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.
- B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

#### 1.8 WARRANTY

- A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
- B. Provide three year manufacturer warranty for all LED luminaires, including drivers.

#### 1.9 COORDINATION

- A. Furnish bolt templates and pole mounting accessories to installer of pole foundations.

### PART 2 PRODUCTS

#### 2.1 LUMINAIRE TYPES

- A. Furnish products as indicated in luminaire schedule included on the drawings.



## 2.2 LUMINAIRES

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products that are listed and labeled as complying with UL 1598, where applicable.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.
- D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.
- E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, poles, foundations, supports, trims, accessories, etc. as necessary for a complete operating system.
- F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.
- G. Provide luminaires listed and labeled as suitable for wet locations unless otherwise indicated.
- H. Recessed Luminaires:
  - 1. Ceiling Compatibility: Comply with NEMA LE 4.
  - 2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
  - 3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.
- I. LED Luminaires:
  - 1. Components: UL 8750 recognized or listed as applicable.
  - 2. Tested in accordance with IES LM-79 and IES LM-80.
  - 3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.
- J. LED Luminaire Components: UL 8750 recognized or listed as applicable.
- K. Exposed Hardware: Stainless steel.

## 2.3 BALLASTS

- A. Ballasts/Drivers - General Requirements:
  - 1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
  - 2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

## 2.4 POLES

- A. All Poles:
  - 1. Provide poles and associated support components suitable for the luminaire(s) and associated supports and accessories to be installed.
  - 2. Structural Design Criteria:
    - a. Comply with AASHTO LTS.
    - b. Wind Load: Include effective projected area (EPA) of luminaire(s) and associated supports and accessories to be installed.
    - c. Dead Load: Include weight of proposed luminaire(s) and associated supports and accessories.
  - 3. Material: Steel, unless otherwise indicated.
  - 4. Shape: Square tapered, unless otherwise indicated.

5. Finish: Match luminaire finish, unless otherwise indicated.
6. Mounting: Install on concrete foundation, height as indicated on the drawings, unless otherwise indicated.
7. Unless otherwise indicated, provide with the following features/accessories:
  - a. Top cap.
  - b. Handhole, 2x4 size.
  - c. Anchor bolts with leveling nuts or leveling shims.
  - d. Metallic Anchor base cover.
  - e. Internal vibration dampers.

B. Metal Poles: Provide ground lug, accessible from handhole.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

- A. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.
- B. Verify that suitable support frames are installed where required.
- C. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.
- D. Verify that conditions are satisfactory for installation prior to starting work.

#### 3.2 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

#### 3.3 INSTALLATION

- A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install products in accordance with manufacturer's instructions.
- D. Install luminaires in accordance with NECA/IESNA 501.
- E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.
- F. Recessed Luminaires:
  1. Install trims tight to mounting surface with no visible light leakage.
  2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
  3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.
- G. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.
- H. Pole-Mounted Luminaires:
  1. Maintain the following minimum clearances:
    - a. Comply with IEEE C2.
    - b. Comply with utility company requirements.

2. Foundation-Mounted Poles:
    - a. Provide cast-in-place concrete foundations for poles as indicated, in accordance with Section 03 3000.
      - 1) Install anchor bolts plumb per template furnished by pole manufacturer.
      - 2) Position conduits to enter pole shaft.
    - b. Install foundations plumb.
    - c. Install poles plumb, using leveling nuts or shims as required to adjust to plumb.
    - d. Tighten anchor bolt nuts to manufacturer's recommended torque.
    - e. Install anchor base covers as indicated.
  3. Grounding:
    - a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.
    - b. Provide supplementary ground rod electrode as specified in Section 26 0526 at each pole bonded to grounding system as indicated.
  4. Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.
- I. Install accessories furnished with each luminaire.
  - J. Bond products and metal accessories to branch circuit equipment grounding conductor.
  - K. Install lamps in each luminaire.
- 3.4 FIELD QUALITY CONTROL
- A. See Section 01 4000 - Quality Requirements, for additional requirements.
  - B. Inspect each product for damage and defects.
  - C. Operate each luminaire after installation and connection to verify proper operation.
  - D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Engineer.
- 3.5 ADJUSTING
- A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Engineer. Secure locking fittings in place.
- 3.6 CLEANING
- A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.
- 3.7 CLOSEOUT ACTIVITIES
- 3.8 PROTECTION
- A. Protect installed luminaires from subsequent construction operations.
- 3.9 ATTACHMENTS
- A. Luminaire schedule.

END OF SECTION 26 5600

## SECTION 27 1005 - STRUCTURED CABLING FOR VOICE AND DATA

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Communications system design requirements.
- B. Communications pathways.
- C. Copper cable and terminations.
- D. Fiber optic cable and interconnecting devices.
- E. Communications equipment room fittings.
- F. Communications outlets.
- G. Communications grounding and bonding.
- H. Communications identification.
- I. Distribution frames, cross-connection equipment, enclosures, and outlets.
- J. Grounding and bonding the telecommunications distribution system.

#### 1.2 RELATED REQUIREMENTS

- A. Section 07 8400 - Firestopping.
- B. Section 26 0526 - Grounding and Bonding.
- C. Section 26 0533.13 - Conduit for Electrical Systems.
- D. Section 26 0536 - Cable Trays.
- E. Section 26 0533.16 - Boxes for Electrical Systems.
- F. Section 26 0553 - Identification for Electrical Systems: Identification products.
- G. Section 26 2726 - Wiring Devices.

#### 1.3 REFERENCE STANDARDS

- A. EIA/ECA-310 - Cabinets, Racks, Panels, and Associated Equipment; Electronic Industries Alliance/Electrical Components Association; Revision E, 2005.
- B. ICEA S-83-596 - Indoor Optical Fiber Cables; Insulated Cable Engineers Association; 2011.
- C. ICEA S-90-661 - Category 3, 5, & 5e Individually Unshielded Twisted Pair Indoor Cables (With or Without An Overall Shield) For Use in General Purpose and LAN Communications Wiring Systems Technical Requirements; 2012.
- D. NECA/BICSI 568 - Standard for Installing Building Telecommunications Cabling; National Electrical Contractors Association; 2006.
- E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. TIA-455-21 - FOTP-21 - Mating Durability of Fiber Optic Interconnecting Devices; 2012.

- G. TIA-492AAAB-A - Detail Specification for 50-um Core Diameter/125-um Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers; Rev A, 2009.
- H. TIA-492AAAC-B - Detail Specification for 850-nm Laser-Optimized, 50-um Core Diameter/125-um Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers; Telecommunications Industry Association; 2009.
- I. TIA-492AAAD - Detail Specification for 850-nm Laser-Optimized, 50-um Core Diameter/125-um Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers; Telecommunications Industry Association; 2009.
- J. TIA-526-14 - Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant; Rev C, 2015.
- K. TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set; 2015.
- L. TIA-568-C.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards; Rev C, 2009 (with Addenda; 2014).
- M. TIA-568-C.3 - Optical Fiber Cabling Components Standard; Rev C, 2008 (with Addenda; 2011).
- N. TIA-569-C - Commercial Building Standard for Telecommunications Pathways and Spaces; Rev C, 2012 (with Addenda; 2013).
- O. TIA-598-C - Optical Fiber Cable Color Coding; Rev C, 2005.
- P. TIA-606-B - Administration Standard for the Telecommunications Infrastructure; Rev B, 2012.
- Q. TIA-607-B - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises; Rev B, 2012 (with Addenda; 2013).
- R. ANSI/J-STD-607 - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications; Rev A, 2002.
- S. UL 444 - Communications Cables; Current Edition, Including All Revisions.
- T. UL 1651 - Fiber Optic Cable; Current Edition, Including All Revisions.
- U. UL 1863 - Communications-Circuit Accessories; Current Edition, Including All Revisions.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate requirements for service entrance and entrance facilities with Communications Service Provider.
  - 2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for communications equipment.
  - 3. Coordinate arrangement of communications equipment with the dimensions and clearance requirements of the actual equipment to be installed.
  - 4. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.
- B. Arrange for Communications Service Provider to provide service.
- C. Preinstallation Meeting: Convene one week prior to commencing work of this section to review service requirements and details with Communications Service Provider representative.

## 1.5 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.
- C. Shop Drawings: Show compliance with requirements on isometric schematic diagram of network layout, showing cable routings, telecommunication closets, rack and enclosure layouts and locations, service entrance, and grounding, prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).
- D. Manufacturer Qualifications.
- E. Evidence of qualifications for installer.
- F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and operation of product.
- G. Test Plan: Complete and detailed plan, with list of test equipment, procedures for inspection and testing, and intended test date; submit at least 60 days prior to intended test date.
- H. Field Test Reports.
- I. Project Record Documents: Prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).
  - 1. Record actual locations of outlet boxes and distribution frames.
  - 2. Show as-installed color coding, pair assignment, polarization, and cross-connect layout.
  - 3. Identify distribution frames and equipment rooms by room number on contract drawings.
- J. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of project record documents.

## 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: At least 3 years experience manufacturing products of the type specified.
- B. Installer Qualifications: A company having at least 3 years experience in the installation and testing of the type of system specified, and:
  - 1. Employing a BICSI Registered Communications Distribution Designer (RCDD).
  - 2. Supervisors and installers factory certified by manufacturers of products to be installed.
  - 3. Employing BICSI Registered Cabling Installation Technicians (RCIT) for supervision of all work.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.

- B. Keep stored products clean and dry.

## 1.8 WARRANTY

- A. Correct defective Work within a 2 year period after Date of Substantial Completion.
- B. Provide manufacturers standard warranty, minimum 20 years for a complete system, including all cabling, jacks, and patch panels.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Cabling and Equipment:
  - 1. Commscope Uniprise.
  - 2. Hubbell Premise Wiring.

### 2.2 SYSTEM DESIGN

- A. Provide a complete permanent system of cabling and pathways for voice and data communications, including cables, cable or basket trays, conduits and wireways, pull wires, support structures, enclosures and cabinets, and outlets.
  - 1. Comply with TIA-568 (SET) (cabling) and TIA-569-C (pathways), latest editions (commercial standards).
  - 2. Provide fixed cables and pathways that comply with NFPA 70 and TIA-607-B and are UL listed or third party independent testing laboratory certified.
  - 3. Provide connection devices that are rated for operation under conditions of 32 to 140 degrees F at relative humidity of 0 to 95 percent, noncondensing.
  - 4. In this project, the term plenum is defined as return air spaces above ceilings, inside ducts, under raised floors, and other air-handling spaces.
- B. System Description:
  - 1. Building Entrance Cable: By others.
  - 2. Horizontal Cabling: Copper.
- C. Main Distribution Frame (MDF): Centrally located support structure for terminating horizontal cables that extend to telecommunications outlets, functioning as point of presence to external service provider.
  - 1. Locate main distribution frame as indicated on the drawings.
  - 2. Capacity: As required to terminate all cables required by design criteria plus minimum 25 percent spare space.
- D. Intermediate Distribution Frames (IDF): Support structures for terminating horizontal cables that extend to telecommunications outlets.
  - 1. Locate intermediate distribution frames as indicated on the drawings.
- E. Backbone Cabling: Cabling, pathways, and terminal hardware connecting intermediate distribution frames (IDF's) with main distribution frame (MDF), wired in star topology with main distribution frame at center hub of star.
- F. Cabling to Outlets: Specified horizontal cabling, wired in star topology to distribution frame located at center hub of star; also referred to as "links".

### 2.3 PATHWAYS

- A. Conduit: As specified in Section 26 0533.13; provide pull cords in all conduit.
- B. Underground Service Entrance: Rigid polyvinyl chloride (PVC) conduit, Schedule 40.

## 2.4 COPPER CABLE AND TERMINATIONS

### A. Copper Backbone Cable:

1. Description: 100 ohm, balanced twisted pair cable complying with TIA-568-C.2, ICEA S-90-661, and listed and labeled as complying with UL 444; arranged in 25-pair binder groups.
2. Cable Type: TIA-568-C.2 Category 3 UTP (unshielded twisted pair); 24 AWG.
3. Cable Capacity: Quantity of pairs as indicated on drawings.
4. Cable Applications:
  - a. Plenum Applications: Use listed NFPA 70 Type CMP plenum cable.
  - b. Riser Applications: Use listed NFPA 70 Type CMR riser cable or Type CMP plenum cable.

### B. Copper Horizontal Cable:

1. Description: 100 ohm, balanced twisted pair cable complying with TIA-568-C.2 and listed and labeled as complying with UL 444.
2. Cable Type - Voice and Data: TIA-568-C.2 Category 6 UTP (unshielded twisted pair); 23 AWG.
3. Cable Capacity: 4-pair.
4. Cable Applications: Use listed NFPA 70 Type CMP plenum cable unless otherwise indicated.
5. Cable Jacket Color - Voice and Data Cable: White.
6. Product(s):
  - a. Commscope Uniprise:
    - 1) Category 6 Cable: Ultramedia Solution, or equal

### C. Copper Cable Terminations: Insulation displacement connection (IDC) type using appropriate tool; use screw connections only where specifically indicated.

### D. Jacks and Connectors: Modular RJ-45, non-keyed, terminated with 110-style insulation displacement connectors (IDC); high impact thermoplastic housing; suitable for and complying with same standard as specified horizontal cable; UL 1863 listed.

1. Performance: 500 mating cycles.
2. Voice and Data Jacks: 8-position modular jack, color-coded for both T568A and T568B wiring configurations.

### E. Copper Patch Cords:

1. Description: Factory-fabricated 4-pair cable assemblies with 8-position modular connectors terminated at each end.
2. Patch Cords for Patch Panels:
  - a. Quantity: One for every two patch panel ports.
  - b. Length: Plan for 3ft, coordinate exact requirements with the owner.
3. Patch Cords for Work Areas:
  - a. Quantity: One for every two work area outlet ports.
  - b. Length: Plan for 10ft, coordinate exact requirements with the owner.

## 2.5 FIBER OPTIC CABLE AND INTERCONNECTING DEVICES

### A. Fiber Optic Backbone Cable:

1. Description: Tight buffered, non-conductive fiber optic cable complying with TIA-568-C.3, TIA-598-C, ICEA S-83-596 and listed as complying with UL 444 and UL 1651.
2. Cable Type: Multimode, laser-optimized 50/125 um (OM3) complying with TIA-492AAAC-B.
3. Cable Capacity: 12-fiber.
4. Cable Applications:



- a. Plenum Applications: Use listed NFPA 70 Type OFNP plenum cable.
  - 5. Cable Jacket Color:
    - a. Multimode Fiber (OM1/OM2): Orange.
  - B. Fiber Optic Interconnecting Devices:
    - 1. Connector Type: Type LC.
    - 2. Connector Performance: 500 mating cycles, when tested in accordance with TIA-455-21.
    - 3. Maximum Attenuation/Insertion Loss: 0.3 dB.
- 2.6 COMMUNICATIONS EQUIPMENT ROOM FITTINGS
- A. Backboards: Interior grade plywood without voids, 3/4 inch thick; UL-labeled fire-retardant.
    - 1. Size: As indicated on drawings.
    - 2. Do not paint over UL label.
  - B. Equipment Racks and Cabinets: EIA/ECA-310 standard 19 inch wide component racks.
    - 1. Wall Mounted Racks: Steel construction, hinged to allow access to back of installed components.
    - 2. Floor Mounted Racks: Aluminum or steel construction with corrosion resistant finish; vertical and horizontal cable management channels, top and bottom cable troughs, and grounding lug.
    - 3. Freestanding Cabinets: Front and rear doors with locks; removable side panels with locks; vented top and rear door; adjustable leveling feet; cable access in roof and base; grounding bar.
    - 4. Cabinets: Steel construction with corrosion resistant finish.
    - 5. Locks: Keyed alike.
- 2.7 COMMUNICATIONS OUTLETS
- A. Outlet Boxes: Comply with Section 26 0533.16.
    - 1. Provide depth as required to accommodate cable manufacturer's recommended minimum conductor bend radius.
    - 2. Minimum Size, Unless Otherwise Indicated:
      - a. Outlets: 4-11/16 inch square by 2-1/8 inch deep (119 by 54 mm) trade size.
  - B. Wall Plates:
    - 1. Comply with system design standards and UL 514C.
    - 2. Accepts modular jacks/inserts.
    - 3. Wall Plate Material/Finish - Flush-Mounted Outlets: Match wiring device and wall plate finishes specified on the drawings.
- 2.8 GROUNDING AND BONDING COMPONENTS
- A. Comply with TIA-607-B.
  - B. Comply with Section 26 0526.
- 2.9 IDENTIFICATION PRODUCTS
- A. Comply with TIA-606-B.
  - B. Comply with Section 26 0553.

### PART 3 EXECUTION

#### 3.1 INSTALLATION - GENERAL

- A. Comply with latest editions and addenda of TIA-568 (SET) (cabling), TIA-569-C (pathways), TIA-607-B (grounding and bonding), NECA/BICSI 568, NFPA 70, and SYSTEM DESIGN as specified in PART 2.
- B. Comply with Communication Service Provider requirements.
- C. Grounding and Bonding: Perform in accordance with TIA-607-B and NFPA 70.
- D. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

#### 3.2 INSTALLATION OF PATHWAYS

- A. Install pathways with the following minimum clearances:
  - 1. 48 inches from motors, generators, frequency converters, transformers, x-ray equipment, and uninterruptible power systems.
  - 2. 12 inches from power conduits and cables and panelboards.
  - 3. 5 inches from fluorescent and high frequency lighting fixtures.
  - 4. 6 inches from flues, hot water pipes, and steam pipes.
- B. Conduit, in Addition to Requirements of Section 26 0533.13:
  - 1. Arrange conduit to provide no more than the equivalent of two 90 degree bend(s) between pull points.
  - 2. Conduit Bends: Inside radius not less than 10 times conduit internal diameter.
  - 3. Arrange conduit to provide no more than 100 feet between pull points.
  - 4. Do not use conduit bodies.
- C. Outlet Boxes:
  - 1. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of telecommunications outlets provided under this section.
    - a. Mounting Heights: Unless otherwise indicated, as follows:
      - 1) Telephone and Data Outlets: 18 inches above finished floor.
      - 2) Telephone Outlets for Side-Reach Wall-Mounted Telephones: 46 inches above finished floor to top of telephone.
      - 3) Telephone Outlets for Forward-Reach Wall-Mounted Telephones: 46 inches above finished floor to top of telephone.
    - b. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
    - c. Provide minimum of 24 inches horizontal separation between flush mounted outlet boxes installed on opposite sides of fire rated walls.
    - d. Unless otherwise indicated, provide separate outlet boxes for line voltage and low voltage devices.
    - e. Locate outlet boxes so that wall plate does not span different building finishes.
    - f. Locate outlet boxes so that wall plate does not cross masonry joints.

#### 3.3 INSTALLATION OF EQUIPMENT AND CABLING

- A. Cabling:
  - 1. Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair use bend radius of not less than 4 times cable diameter.
  - 2. Do not over-cinch or crush cables.
  - 3. Do not exceed manufacturer's recommended cable pull tension.

4. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.
  5. Cabling shall be installed parallel and perpendicular to building structure. Supported a maximum 4-6 ft.
  6. Install cabling in raceways and/or cable tray system.
- B. Service Loops (Slack or Excess Length): Provide the following minimum extra length of cable, looped neatly:
1. At Distribution Frames: 120 inches.
  2. At Outlets - Copper: 12 inches.
  3. At Outlets - Optical Fiber: 39 inches.
- C. Copper Cabling:
1. Category 5e and Above: Maintain cable geometry; do not untwist more than 1/2 inch from point of termination.
  2. For 4-pair cables in conduit, do not exceed 25 pounds pull tension.
  3. Use T568B wiring configuration.
- D. Fiber Optic Cabling:
1. Prepare for pulling by cutting outer jacket for 10 inches from end, leaving strength members exposed. Twist strength members together and attach to pulling eye.
  2. Support vertical cable at intervals as recommended by manufacturer.
- E. Wall-Mounted Racks and Enclosures:
1. Install to plywood backboards only, unless otherwise indicated.
  2. Mount so height of topmost panel does not exceed 78 inches above floor.
- F. Floor-Mounted Racks and Enclosures: Permanently anchor to floor in accordance with manufacturer's recommendations.
- G. Identification:
1. Use wire and cable markers to identify cables at each end.
  2. Use manufacturer-furnished label inserts or identification labels to identify each jack at communications outlets with unique identifier.
  3. Use identification nameplate to identify cross-connection equipment, equipment racks, and cabinets.
- 3.4 FIELD QUALITY CONTROL
- A. See Section 01 4000 - Quality Requirements, for additional requirements.
- B. Comply with inspection and testing requirements of specified installation standards.
- C. Visual Inspection:
1. Inspect cable jackets for certification markings.
  2. Inspect cable terminations for color coded labels of proper type.
  3. Inspect outlet plates and patch panels for complete labels.
- D. Testing - Copper Cabling and Associated Equipment:
1. Test backbone cables after termination but before cross-connection.
  2. Test backbone cables for DC loop resistance, shorts, opens, intermittent faults, and polarity between connectors and between conductors and shield, if cable has overall shield.
  3. Test operation of shorting bars in connection blocks.
  4. Category 3 Backbone: Perform attenuation test.
  5. Category 3 Links: Test each pair for short circuit continuity, short to ground, crosses, reversed polarity, operational and ring-back, and dial tone.

6. Category 5e and Above Backbone: Perform near end cross talk (NEXT) and attenuation tests.
  7. Category 5e and Above Links: Perform tests for wire map, length, attenuation, NEXT, and propagation delay.
- E. Testing - Fiber Optic Cabling:
1. Multimode Backbone: Perform tests in accordance with TIA-526-14.
- F. Final Testing: After all work is complete, including installation of telecommunications outlets, and telephone dial tone service is active, test each voice jack for dial tone.

END OF SECTION 27 1005

## SECTION 27 5116 - PUBLIC ADDRESS SYSTEMS

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Amplifier and control equipment.
- B. Input equipment.
- C. Sound system cable.
- D. Speakers

#### 1.2 RELATED REQUIREMENTS

- A. Section 26 0526 - Grounding and Bonding.
- B. Section 26 0533.16 - Boxes for Electrical Systems.

#### 1.3 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

#### 1.4 SYSTEM DESCRIPTION

- A. Public address system for music.
- B. Input components:
  - 1. AM/FM tuner.
  - 2. MP3/iPod
- C. Features:
  - 1. Distribution of background music.

#### 1.5 SUBMITTALS

- A. Shop Drawings: Indicate electrical characteristics and connection requirements. Indicate layout of equipment mounted in racks and cabinets, component interconnecting wiring, and wiring diagrams of field wiring to speakers and remote input devices.
- B. Product Data: Provide data showing electrical characteristics and connection requirements for each component.
- C. Test Reports: Indicate satisfactory completion of each test recommended by the manufacturer.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Manufacturer's Field Reports: Indicate that installation is complete and system performs according to specified requirements.
- G. Project Record Documents: Record actual locations of speakers, control equipment, and outlets for input/output connectors.

- H. Operation Data: Include instructions for adjusting, operating, and extending the system.
- I. Maintenance Data: Include repair procedures and spare parts documentation.

#### 1.6 COORDINATION

- A. Coordinate the layout and installation of ceiling mounted speakers with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire suppression systems and fire alarm systems.
- B. Coordinate the installation of wiring with other wiring systems installed.
- C. Coordinate all room numbers and paging zones with field room numbers.

#### 1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience with service facilities within 50 miles of Project.
- B. Supplier Qualifications: Authorized distributor of specified manufacturer with minimum three years documented experience.
- C. Installer Qualifications: Authorized installer of specified manufacturer with service facilities within 50 miles of Project.
- D. Products: Listed, classified, and labeled as suitable for the purpose intended.
- E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

### PART 2 PRODUCTS

#### 2.1 MANUFACTURERS

- A. Bogen Communications, Inc: [www.bogen.com](http://www.bogen.com).
- B. Rauland.
- C. Dukane.

#### 2.2 AMPLIFICATION AND CONTROL EQUIPMENT

- A. System Frequency Response: 50 to 15,000 Hz, plus or minus 2 dB.
- B. System Distortion: Less than 1.5 percent, 100 to 100,000 Hz at rated power.
- C. Volume Controls: One for each input and one master volume.
- D. System Cabinet: Rack mounted.

#### 2.3 COMPONENTS

- A. AM/FM Tuner: Tuner with 525 to 1605 kHz AM and 88 to 108 MHz FM tuning range.
- B. Speakers: 8 inch coaxial speaker with integral crossover circuit.
  - 1. Product: Soundolier, Atlas, Electro-Voice.
- C. Speaker Baffles and Enclosure: Round, painted steel, with uniform perforations.
  - 1. Size: 12 inch.
  - 2. Finish: White.

- 3. Speaker Backbox: Insulated with sound-deadening material.
  - D. Matching Transformers: Tapped from 0.5 to 4 watts in 1 watt steps, with primary/secondary ratio to match amplifier to speaker impedances.
  - E. Volume Pads: Transformer type rated 10 watts.
  - F. Equipment Rack: Wall mounted equipment Cabinet.
    - 1. Finish: Gray enamel finish.
    - 2. Include front hinged and latched door.
  - G. Antenna: Folded dipole FM antenna.
- 2.4 WIRE AND CABLE
- A. Input Cable: 22 AWG copper conductor, 300 volt insulation, rated 60 degrees C, paired conductors twisted together, shielded, and covered with a PVC jacket.
  - B. Plenum Cable for Speaker Circuits: 22 AWG copper conductor, 300 volt insulation, rated 200 degrees C, paired conductors twisted together and covered with a nonmetallic jacket; suitable for use for Class 2 circuits in air handling ducts, hollow spaces used as ducts, and plenums.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Mounting Heights: Coordinate locations of outlet boxes specified in Section 26 0533.16 to obtain mounting heights indicated.
  - 1. Volume Pad Outlets: 4 feet above finished floor.
- C. Splice cable only in accessible junction boxes or at terminal block units.
- D. Make cable shields continuous at splices and connect speaker circuit shield to equipment ground only at amplifier.
- E. Install input circuits in separate cables and raceways from output circuits.
- F. Leave 18 inches excess cable at each termination at microphone, volume pad, speaker, and other system outlet.
- G. Leave 6 feet excess cable at each termination at system cabinet
- H. Provide protection for exposed cables where subject to damage.
- I. Use armored cable for outside speaker circuits.
- J. Support cables above accessible ceilings to keep them from resting on ceiling tiles. Use spring metal clips or plastic cable ties to support cables from structure for ceiling suspension system. Include bridle rings or drive rings.
- K. Use suitable cable fittings and connectors.
- L. Connect reproducers to amplifier with matching transformers.
- M. Ground and bond equipment and circuits in accordance with Section 26 0526.
- N. Install backbox for all speakers mounted in plenum spaces.

### 3.2 FIELD QUALITY CONTROL

- A. Provide the services of manufacturer's technical representative to prepare and start system.
  - 1. Include making of final wiring connections, inspection and adjusting of completed installation, and systems demonstration.
  - 2. Certify that installation is complete and performs according to specified requirements.
- B. Measure and record sound power levels at designated locations.

### 3.3 ADJUSTING

- A. Adjust transformer taps for appropriate sound level.
- B. Adjust devices and wall plates to be flush and level.

### 3.4 CLOSEOUT ACTIVITIES

- A. Demonstration: Demonstrate operation of system to Owner's personnel.
  - 1. Use operation and maintenance data as reference during demonstration.
  - 2. Conduct walking tour of project.
  - 3. Briefly describe function, operation, and maintenance of each component.
- B. Training: Train Owner's personnel on operation and maintenance of system.
  - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
  - 2. Provide minimum of two hours of training.
  - 3. Location: At project site.

END OF SECTION 27 5116



## SECTION 28 4600 - FIRE DETECTION AND ALARM

### PART 1 GENERAL

#### 1.1 SECTION INCLUDES

- A. Fire alarm system design and installation, including all components, wiring, and conduit.
- B. Transmitters for communication with supervising station.
- C. Maintenance of fire alarm system under contract for specified warranty period.

#### 1.2 RELATED REQUIREMENTS

- A. Section 08 7100 - Door Hardware: Electrically operated locks and door holder devices to be monitored and released by fire alarm system.
- B. Section 14 2100 - Electric Traction Elevators: Elevator systems monitored and controlled by fire alarm system.
- C. Section 14 2400 - Hydraulic Elevators: Elevator systems monitored and controlled by fire alarm system.
- D. Section 21 1300 - Fire-Suppression Sprinkler Systems: Supervisory, alarm, and actuating devices installed in sprinkler system.
- E. Section 23 3300 - Air Duct Accessories: Smoke dampers monitored and controlled by fire alarm system.

#### 1.3 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- C. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Cor 1, 2012).
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. NFPA 72 - National Fire Alarm and Signaling Code; 2016.
- F. NFPA 101 - Life Safety Code; 2015.
- G. IBC - International Building Code
- H. IFC - International Fire Code

#### 1.4 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Evidence of designer qualifications.

- C. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
  - 1. Copy (if any) of list of data required by authority having jurisdiction.
  - 2. NFPA 72 "Record of Completion", filled out to the extent known at the time.
  - 3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
  - 4. System zone boundaries and interfaces to fire safety systems.
  - 5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
  - 6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
  - 7. List of all devices on each signaling line circuit, with spare capacity indicated.
  - 8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
  - 9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
  - 10. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
  - 11. Certification by the manufacturer of the control unit that the system design complies with the contract documents.
  - 12. Certification by Contractor that the system design complies with the contract documents.
- D. Evidence of installer qualifications.
- E. Shop Drawings: Shall include:
  - 1. Design Documents, after approval by the Authority having jurisdiction.
  - 2. Designer Qualifications
  - 3. Installer qualifications
  - 4. Product Data
- F. Inspection and Test Reports:
  - 1. Submit inspection and test plan prior to closeout demonstration.
  - 2. Submit documentation of satisfactory inspections and tests.
  - 3. Submit NFPA 72 "Inspection and Test Form," filled out.
- G. Operating and Maintenance Data: See Section 01 7800 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
  - 1. Complete set of specified design documents, as approved by authority having jurisdiction.
  - 2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
  - 3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
  - 4. List of recommended spare parts, tools, and instruments for testing.
  - 5. Replacement parts list with current prices, and source of supply.
  - 6. Detailed troubleshooting guide and large scale input/output matrix.
  - 7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.

8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.
  - H. Project Record Documents: See Section 01 7800 for additional requirements; have one set available during closeout demonstration:
    1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
    2. "As installed" wiring and schematic diagrams, with final terminal identifications.
    3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.
  - I. Closeout Documents:
    1. Certification by manufacturer that the system has been installed in compliance with his installation requirements, is complete, and is in satisfactory operating condition.
    2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
    3. Maintenance contract.
- 1.5 WARRANTY
- A. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 1 year after date of Substantial Completion.
  - B. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Fire Alarm Control Units - Basis of Design: Honeywell Security & Fire Solutions/Gamewell-FCI: [www.gamewell-fci.com](http://www.gamewell-fci.com).
- B. Fire Alarm Control Units - Other Acceptable Manufacturers: Provided their products meet or exceed the performance of the basis of design product, products of the following are acceptable:
  1. Honeywell Security & Fire Solutions/Notifier: [www.notifier.com](http://www.notifier.com).
  2. Provide all control units made by the same manufacturer.
- C. Initiating Devices, and Notification Appliances:
  1. Same manufacturer as control units.

### 2.2 FIRE ALARM SYSTEM

- A. Fire Alarm System: Provide a new automatic fire detection and alarm system:
  1. Provide all components necessary, regardless of whether shown in the contract documents or not.
  2. Protected Premises: Entire building shown on drawings.
  3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
    - a. ADA Standards.
    - b. The requirements of the State Fire Marshal.
    - c. The requirements of the local authority having jurisdiction .
    - d. Applicable local codes.

- e. The contract documents (drawings and specifications).
  - f. NFPA 101.
  - g. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
  - 4. Evacuation Alarm: Single smoke zone; general evacuation of entire premises.
  - 5. Master Control Unit (Panel): New, located at where shown on the plans.
  - B. Supervising Stations and Fire Department Connections:
    - 1. Public Fire Department Notification: By remote supervising station.
    - 2. Remote Supervising Station: UL-listed central station under contract to facility.
    - 3. Means of Transmission to Remote Supervising Station: Digital alarm communicator transmitter (DACT), 2 telephone lines.
  - C. Circuits:
    - 1. Initiating Device Circuits (IDC): Class B, Style A.
    - 2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.
    - 3. Notification Appliance Circuits (NAC): Class B, Style W.
  - D. Spare Capacity:
    - 1. Initiating Device Circuits: Minimum 25 percent spare capacity.
    - 2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
    - 3. Master Control Unit: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.
  - E. Power Sources:
    - 1. Primary: Dedicated branch circuits of the facility power distribution system.
    - 2. Secondary: Storage batteries.
    - 3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
    - 4. Each Computer System: Provide uninterruptible power supply (UPS).
- 2.3 FIRE SAFETY SYSTEMS INTERFACES
- A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:
    - 1. Sprinkler water control valves.
    - 2. Elevator shut-down control circuits.
  - B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:
    - 1. Sprinkler water flow.
    - 2. Elevator lobby, elevator hoistway, and elevator machine room smoke detectors.
    - 3. Duct smoke detectors.
  - C. Elevators:
    - 1. Elevator lobby, hoistway, and machine room smoke detectors: Elevator recall for fire fighters' service.
    - 2. Elevator Machine Room Heat Detector: Shut down elevator power prior to hoistway sprinkler activation.
    - 3. Sprinkler pressure or waterflow: Shut down elevator power prior to hoistway sprinkler activation.
  - D. HVAC:
    - 1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.
      - a. Provide remote test station for any duct detector not readily accessible as required by NFPA.

- E. Doors:
  - 1. Electromagnetic Door Locks on Egress Doors: Unlock upon activation of any alarm initiating device or suppression system in smoke zone that doors serve as egress from. Refer to Section 08 7100.

## 2.4 COMPONENTS

- A. General:
  - 1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
    - a. Surface mounted devices shall be provided with matching backbox from same manufacturer.
  - 2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.
- B. Fire Alarm Control Units, Initiating Devices, and Notification Appliances: Analog, addressable type; listed, classified, and labeled as suitable for the purpose intended.
- C. Master Control Unit: As specified for Basis of Design above, or equivalent.
- D. Initiating Devices:
- E. Notification Appliances:
  - 1. Speakers: provide White devices.
- F. Circuit Conductors: Copper or optical fiber; provide 200 feet extra; color code and label.
- G. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.
  - 1. Equipment Connected to Alternating Current Circuits: Maximum let through voltage of 350 V(ac), line-to-neutral, and 350 V(ac), line-to-line; do not use fuses.
  - 2. Initiating Device Circuits, Notification Appliance Circuits, and Communications Circuits: Provide surge protection at each point where circuit exits or enters a building; rated to protect applicable equipment; for 24 V(dc) maximum dc clamping voltage of 36 V(dc), line-to-ground, and 72 V(dc), line-to-line.
  - 3. Signaling Line Circuits: Provide surge protection at each point where circuit exits or enters a building, rated to protect applicable equipment.
- H. Locks and Keys: Deliver keys to Owner.
  - 1. Provide the same standard lock and key for each key operated switch and lockable panel and cabinet; provide 5 keys of each type
- I. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
  - 1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
  - 2. Provide one for each control unit where operations are to be performed.
  - 3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
  - 4. Provide extra copy with operation and maintenance data submittal.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and the contract documents.
- B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.
- C. All wiring installed in exposed areas or above non-accessible ceilings or in walls shall be installed in conduit.
- D. Obtain Owner's approval of locations of devices, before installation.
  - 1. Install wall mounted strobes at 80" to the bottom.
  - 2. Install manual pull stations at 48" to the top. Align with adjacent light switches, where applicable.
- E. Install instruction cards and labels.

### 3.2 INSPECTION AND TESTING FOR COMPLETION

- A. Notify Owner 7 days prior to beginning completion inspections and tests.
- B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.
- C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.
- D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.
- E. Provide all tools, software, and supplies required to accomplish inspection and testing.
- F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.
- G. Correct defective work, adjust for proper operation, and retest until entire system complies with contract documents.

### 3.3 OWNER PERSONNEL INSTRUCTION

- A. Provide the following instruction to designated Owner personnel:
  - 1. Hands-On Instruction: On-site, using operational system.
- B. Administrative: One-hour session(s) covering issues necessary for non-technical administrative staff; classroom:
  - 1. Initial Training: 1 session pre-closeout.
- C. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
  - 1. Initial Training: 1 session pre-closeout.
- D. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.

### 3.4 CLOSEOUT

- A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
  - 1. Be prepared to conduct any of the required tests.

2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
3. Have authorized technical representative of control unit manufacturer present during demonstration.
4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
5. Repeat demonstration until successful.

### 3.5 MAINTENANCE

- A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.
- B. Provide to Owner, at no extra cost, a written maintenance contract for entire manufacturer's warranty period, to include the work described below.
- C. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
  1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
  2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
  3. Record keeping required by NFPA 72 and authorities having jurisdiction.
- D. Provide trouble call-back service upon notification by Owner:
  1. Provide on-site response within 2 hours of notification.
  2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
  3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.
- E. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.
- F. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.
- G. Comply with Owner's requirements for access to facility and security.

END OF SECTION 28 4600