

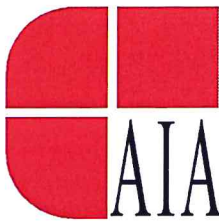
---

# PROJECT MANUAL

## RENOVATION TO FAIN FINE ARTS BUILDING

### MIDWESTERN STATE UNIVERSITY

3410 TAFT BOULEVARD  
WICHITA FALLS, TEXAS



# HARPER PERKINS ARCHITECTS, INC.

ARCHITECTS PROGRAMMERS PLANNERS



4724 OLD JACKSBORO HIGHWAY  
WICHITA FALLS, TEXAS 76302-3599

EXP DATE: 25 August 2017  
DATE: 2-27-17

Architect's Project No. 16782.01

February 3, 2017



**RENOVATION TO  
FAIN FINE ARTS BUILDING  
MIDWESTERN STATE UNIVERSITY  
WICHITA FALLS, TEXAS**

**BOARD OF REGENTS**

Mr. Samuel M. Sanchez, Chair  
Mr. Warren Ayres, Regent  
Ms. Tiffany Burks, Regent  
Mr. R. Caven Crosnoe, Regent  
Dr. F. Lynwood Givens, Regent  
Mr. Shawn Hessing, Regent  
Mr. Jeff Gregg, Regent  
Ms. Nancy Marks, Regent  
Dr. Shelley Sweatt, Regent  
Ms. Lindsey Shelley, Student Regent

**Dr. Suzanne Shipley, President**

**HARPER PERKINS ARCHITECTS**

4724 OLD JACKSBORO HIGHWAY  
Voice: 940-767-1421  
Web: [www.harperperkins.com](http://www.harperperkins.com)

WICHITA FALLS, TEXAS 76302-3599  
FAX: 940-397-0273  
E-Mail: [office@harperperkins.com](mailto:office@harperperkins.com)



## TABLE OF CONTENTS



EXP. DATE: AUGUST 25, 2107

DATE: FEBRUARY 27, 2017

### BIDDING REQUIREMENTS - RFP #735-17-8175 – PROVIDED BY MSU

#### Request for Proposal

- General Terms and Conditions
- Instructions for Submitting Bids
- Request for Proposal
- Specifications
- Bid Sheet
- Vendor References
- Affidavit
- Agreement (Sample)

### DIVISION 1 - GENERAL REQUIREMENTS

011000	Summary & Bid Packages	011000-1 thru 011000-05
012300	Alternates	012300-1 thru 012300-02
012500	Substitution Procedures	012500-1 thru 012500-04
012600	Contract Modification Procedures	012600-1 thru 012600-03
012900	Payment Procedures	012900-1 thru 012900-04
013100	Project Management and Coordination	013100-1 thru 013100-07
013200	Construction Progress Documentation	013200-1 thru 013200-08
013300	Submittal Procedures	013300-1 thru 013300-09
014000	Quality Requirements	014000-1 thru 014000-08
014200	References	014200-1 thru 014200-02
015000	Temporary Facilities and Controls	015000-1 thru 015000-07
016000	Product Requirements	016000-1 thru 016000-05
017300	Execution	017300-1 thru 017300-07
017700	Closeout Procedures	017700-1 thru 017700-06
017823	Operation and Maintenance Data	017823-1 thru 017823-07
017839	Project Record Documents	017839-1 thru 017839-05
017900	Demonstration and Training	017900-1 thru 017900-06

**DIVISION 2 - SITEWORK**

024119 Selective Structure Demolition

024119-01 thru 024119-07

**DIVISION 3 – CONCRETE**

033000 Cast-In-Place Concrete

033000-01 thru 033000-18

**DIVISION 4 - MASONRY**

NOT USED

**DIVISION 5 - METALS**

NOT USED

**DIVISION 6 - WOOD AND PLASTICS**

061000 Rough Carpentry

061000-01 thru 061000-07

**DIVISION 7 - THERMAL AND MOISTURE PROTECTION**

072100 Thermal Insulation

072100-01 thru 072100-03

072700 Fire Stopping

072700-01 thru 072700-10

079200 Joint Sealants

079200-01 thru 079200-08

**DIVISION 8 - DOORS AND WINDOWS**

081113 Steel Metal Doors and Frames

081113-01 thru 081113-06

081416 Flush Wood Doors

081416-01 thru 081416-05

087100 Door Hardware

087100-01 thru 087100-13

088000 Glazing

088000-01 thru 088000-05

**DIVISION 9 – FINISHES**

092550 Gypsum Board Assemblies

092500-01 thru 092550-12

095113 Acoustical Panel Ceilings

095113-01 thru 095113-07

096513 Resilient Base and Accessories

096513-01 thru 096513-05

096813 Tile Carpeting

096813-01 thru 096813-06

099100 Painting

099100-01 thru 099100-10

099500 Wall Coverings

099500-01 thru 099500-04

099900 Finish Schedule

099900-01 thru 099900-01

099990 Finish Schedule Key

099990-01 thru 099990-01

**DIVISION 10 - SPECIALTIES**

104250 Signs

104250-01 thru 104250-03

104413 Fire Protection Specialties

104413-01 thru 104413-05

**DIVISION 11 – EQUIPMENT**

NOT USED

**DIVISION 12 – FURNISHINGS**

NOT USED

**DIVISION 13 - SPECIAL CONSTRUCTION**

NOT USED

**DIVISION 14 - CONVEYING SYSTEMS**

NOT USED

**DIVISION 21 – FIRE PROTECTION**

NOT USED

**DIVISION 22 – PLUMBING**

NOT USED

**DIVISION 23 – HEAT VENTILATING AND AIR CONDITIONING**

230713	Duct Insulation	230713-01 thru 230713-13
232113	Metal Ducts	232113-01 thru 232113-12
233300	Air Duct Accessories	233300-01 thru 233300-06
233713	Diffusers, Registers, and Grilles	233713-01 thru 233713-03

**DIVISION 26 – ELECTRICAL- IN MEP SPEC**

260100	General Requirements for Electrical Work	260100-01 thru 260100-11
260519	Low-Voltage Power Conductors and Cables	260519-01 thru 260519-04
260526	Grounding and Bonding for Electrical Systems	260526-01 thru 260526-07
260529	Hangers and Supports for Electrical Systems	260529-01 thru 260529-05
260533	Raceways and Boxes for Electrical Systems	260533-01 thru 260533-10
260553	Identification for Electrical Systems	260553-01 thru 260553-06
262416	Panel Boards	262416-01 thru 262416-09
262726	Wiring Devices	262726-01 thru 262726-08
265116	Interior Lighting	265116-01 thru 265116-06

**DIVISION 28 – ELECTRICAL – IN MEP SPEC**

NOT USED

**DIVISION 31 – EARTHWORK – IN ARCHITECTUAL SPEC**

NOT USED

**DIVISION 32 – EXTERIOR IMPROVEMENTS**

NOT USED

**DIVISION 33 - UTILITIES**

NOT USED

END OF TABLE OF CONTENTS





## **TABLE OF CONTENTS**



EXP. DATE: AUGUST 25, 2107

DATE: FEBRUARY 27, 2017

### **BIDDING REQUIREMENTS - RFP #735-17-8175 – PROVIDED BY MSU**

#### Request for Proposal

- General Terms and Conditions
- Instructions for Submitting Bids
- Request for Proposal
- Specifications
- Bid Sheet
- Vendor References
- Affidavit
- Agreement (Sample)

### **DIVISION 1 - GENERAL REQUIREMENTS**

011000	Summary & Bid Packages	011000-1 thru 011000-05
012300	Alternates	012300-1 thru 012300-02
012500	Substitution Procedures	012500-1 thru 012500-04
012600	Contract Modification Procedures	012600-1 thru 012600-03
012900	Payment Procedures	012900-1 thru 012900-04
013100	Project Management and Coordination	013100-1 thru 013100-07
013200	Construction Progress Documentation	013200-1 thru 013200-08
013300	Submittal Procedures	013300-1 thru 013300-09
014000	Quality Requirements	014000-1 thru 014000-08
014200	References	014200-1 thru 014200-02
015000	Temporary Facilities and Controls	015000-1 thru 015000-07
016000	Product Requirements	016000-1 thru 016000-05
017300	Execution	017300-1 thru 017300-07
017700	Closeout Procedures	017700-1 thru 017700-06
017823	Operation and Maintenance Data	017823-1 thru 017823-07
017839	Project Record Documents	017839-1 thru 017839-05
017900	Demonstration and Training	017900-1 thru 017900-06

**DIVISION 2 - SITEWORK**

024119 Selective Structure Demolition

024119-01 thru 024119-07

**DIVISION 3 – CONCRETE**

033000 Cast-In-Place Concrete

033000-01 thru 033000-18

**DIVISION 4 - MASONRY**

NOT USED

**DIVISION 5 - METALS**

NOT USED

**DIVISION 6 - WOOD AND PLASTICS**

061000 Rough Carpentry

061000-01 thru 061000-07

**DIVISION 7 - THERMAL AND MOISTURE PROTECTION**

072100 Thermal Insulation

072100-01 thru 072100-03

072700 Fire Stopping

072700-01 thru 072700-10

079200 Joint Sealants

079200-01 thru 079200-08

**DIVISION 8 - DOORS AND WINDOWS**

081113 Steel Metal Doors and Frames

081113-01 thru 081113-06

081416 Flush Wood Doors

081416-01 thru 081416-05

087100 Door Hardware

087100-01 thru 087100-13

088000 Glazing

088000-01 thru 088000-05

**DIVISION 9 – FINISHES**

092550 Gypsum Board Assemblies

092500-01 thru 092550-12

095113 Acoustical Panel Ceilings

095113-01 thru 095113-07

096513 Resilient Base and Accessories

096513-01 thru 096513-05

096813 Tile Carpeting

096813-01 thru 096813-06

099100 Painting

099100-01 thru 099100-10

099500 Wall Coverings

099500-01 thru 099500-04

099900 Finish Schedule

099900-01 thru 099900-01

099990 Finish Schedule Key

099990-01 thru 099990-01

**DIVISION 10 - SPECIALTIES**

104250 Signs

104250-01 thru 104250-03

104413 Fire Protection Specialties

104413-01 thru 104413-05

**DIVISION 11 – EQUIPMENT**

NOT USED

**DIVISION 12 – FURNISHINGS**

NOT USED

**DIVISION 13 - SPECIAL CONSTRUCTION**

NOT USED

**DIVISION 14 - CONVEYING SYSTEMS**

NOT USED

**DIVISION 21 – FIRE PROTECTION**

NOT USED

**DIVISION 22 – PLUMBING**

NOT USED

**DIVISION 23 – HEAT VENTILATING AND AIR CONDITIONING**

230713	Duct Insulation	230713-01 thru 230713-13
232113	Metal Ducts	232113-01 thru 232113-12
233300	Air Duct Accessories	233300-01 thru 233300-06
233713	Diffusers, Registers, and Grilles	233713-01 thru 233713-03

**DIVISION 26 – ELECTRICAL- IN MEP SPEC**

260100	General Requirements for Electrical Work	260100-01 thru 260100-11
260519	Low-Voltage Power Conductors and Cables	260519-01 thru 260519-04
260526	Grounding and Bonding for Electrical Systems	260526-01 thru 260526-07
260529	Hangers and Supports for Electrical Systems	260529-01 thru 260529-05
260533	Raceways and Boxes for Electrical Systems	260533-01 thru 260533-10
260553	Identification for Electrical Systems	260553-01 thru 260553-06
262416	Panel Boards	262416-01 thru 262416-09
262726	Wiring Devices	262726-01 thru 262726-08
265116	Interior Lighting	265116-01 thru 265116-06

**DIVISION 28 – ELECTRICAL – IN MEP SPEC**

NOT USED

**DIVISION 31 – EARTHWORK – IN ARCHITECTUAL SPEC**

NOT USED

**DIVISION 32 – EXTERIOR IMPROVEMENTS**

NOT USED

**DIVISION 33 - UTILITIES**

NOT USED

END OF TABLE OF CONTENTS

## SECTION 011000 - SUMMARY

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Work covered by the Contract Documents.
  - 2. Type of the Contract.
  - 3. Owner-furnished products.
  - 4. Use of premises.
  - 5. Owner's occupancy requirements.
  - 6. Work restrictions.
  - 7. Specification formats and conventions.
- B. Related Sections include the following:
  - 1. Division 1 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

#### 1.3 PROJECT INFORMATION

- A. Project Identification: Renovations to Fain Fine Arts Building, at Midwestern State University, Existing Facilities.
  - 1. Project Location: Midwestern State University, 3410 Taft Blvd, Wichita Falls, Texas.
- B. Owner: Midwestern State University.
  - 1. Owner's Representative: Kyle Owen
- C. Architect: Harper Perkins Architects, Inc., 4724 Old Jacksboro Highway, Wichita Falls, Texas 76302. Architect's representatives: Ralph B. Perkins (Project Architect) or Sam K. Kenshalo (Project Manager); Phone: (940) 767-1421

#### 1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The work of the Project is defined by the Contract Documents and consists of the following:
  - 1. Limited Renovations to the Music and Drawing Classrooms as shown on the Drawings.
  - 2. The work shall be completed within the summer months. The spaces will be made available at the end of term on May 15, 2017 and will be required to be completed by August 15, 2017.

B. Project Milestones

1. Specific Milestone will be established for project completion with MSU, the Architect and the Contractor. The Milestones are to include:
  - a. Contract negotiation
  - b. Shop Drawing Submittal and all products ordered.
  - c. Completion of Demolition
  - d. Start of the Construction
2. Milestones, once established will be strictly adhered to, missing any of the milestones may be cause for default and termination of the contract.
3. Completion of this Project by the start of school in the fall of 2017 is mandatory.

1.5 TYPE OF CONTRACT

- A. Project will be constructed under a single prime contract with the selected contractor chosen by sealed competitive proposals, and Selection Criteria – Specification Section 00500.

1.6 WORK UNDER OTHER CONTRACTS

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

1.7 OWNER-FURNISHED PRODUCTS

- A. Owner will furnish products indicated. The Work includes providing support systems to receive Owner's equipment and making plumbing, mechanical, and electrical connections and installation of toilet accessories.
  1. Owner will arrange and pay for delivery of Owner-furnished items according to Contractor's Construction Schedule.
  2. After delivery, Owner will inspect delivered items for damage. Contractor shall be present for and assist in Owner's inspection.
  3. If Owner-furnished items are damaged, defective, or missing, Owner will arrange for replacement.
  4. Owner will furnish Contractor the earliest possible delivery date for Owner-furnished products. Using Owner-furnished earliest possible delivery dates, Contractor shall designate delivery dates of Owner-furnished items in Contractor's Construction Schedule.
  5. Contractor shall review Shop Drawings, Product Data, and Samples and return them to Architect noting discrepancies or anticipated problems in use of product.
  6. Contractor is responsible for receiving, unloading, and handling Owner-furnished items at Project site.
  7. Contractor is responsible for protecting Owner-furnished items from damage during storage and handling, including damage from exposure to the elements.
  8. If Owner-furnished items are damaged as a result of Contractor's operations, Contractor shall repair or replace them.
  9. Contractor shall install and otherwise incorporate Owner-furnished items into the Work.

1.8 USE OF PREMISES

- A. General: Contractor shall have full use of premises for construction operations, including use of Project site, during construction period. Contractor's use of premises 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 premises to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
  - 1. Limits: The site limits shall extend west to the parking lot, Fain Fine Arts Building parking lot and across the street from Fain Fine Arts Building. Coordination with MSU will be necessary.
  - 2. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
    - a. Schedule deliveries to minimize use of driveways and entrances.
    - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Condition of the 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. Erect dust proof/security temporary partitions to protect the existing building during construction.

1.9 COORDINATION WITH OCCUPANTS

- A. Full Owner Occupancy: Owner will occupy site and existing building during entire construction period. Coordinate and cooperate with the Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations (limited during this summer work period). Maintain the existing exits unless otherwise indicated.
  - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from and coordination with the Owner and approval of authorities having jurisdiction.
  - 2. Notify Owner not less than 72 (seventy-two) hours in advance of activities that will affect Owner's operations.
  - 3. The building is a secure facility and access shall be through the designated checkpoint.
  - 4. Utility extensions to the addition will require access to portions of the existing building. Coordination with MSU through the Owner's Designated Representative (ODR) is mandatory. Access through the existing building areas may require work to be done at night and/or weekends.
- B. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.
  - 1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.

2. Obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.
3. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of building.
4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.

#### 1.10 WORK RESTRICTIONS

- A. On-Site Work Hours: Work shall be generally performed during normal construction working hours, but is not limited. Work hours shall be as required to meet the schedule. Coordinate work with school test schedules and any other required "Quiet" days, should the level of noise be of magnitude at the school.
- B. Workers Use Restrictions: All tobacco products, illegal drugs, alcohol, and other such products are prohibited from this site.
- C. Firearms are not allowed on site.
- D. Contact by verbal or physical communication with any student of MSU will result in the permanent removal from the construction project of any construction worker.
- E. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
  1. Notify Architect and Owner not less than two (2) days in advance of proposed utility interruptions.
  2. Obtain Architect's and Owner's written permission before proceeding with utility interruptions.
- F. Employee Identification: Provide picture identification tags for all Contractor and Sub-Contractor personnel working on Project site. Require personnel to use identification tags at all times. The tag shall identify the employee and the company by whom the person is employed. Any employee not wearing an identification badge, shall be removed from the site.

#### 1.11 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using the 33-division format and CSI/CSC's "MasterFormat" numbering system.
  1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
  2. Division 1: Sections in Division 1 govern the execution of the Work of all Sections in the Specifications.
- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.

1.12 MISCELLANEOUS PROVISIONS

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000





## SECTION 012300 - ALTERNATES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

1. 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

1. Section includes administrative and procedural requirements for alternates.

#### 1.3 DEFINITIONS

1. 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 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 alternate into the Work. No other adjustments are made to the Contract Sum.

#### 1.4 PROCEDURES

1. 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.
2. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.
3. Execute accepted alternates under the same conditions as other work of the Contract.
4. 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 Proposers Bidding Procedure Note: Each of the Alternates is “stand alone” for each item listed below. Provide a Proposal number that includes a bid for that Alternate item that can be added or deleted from the Base Bid. On your Proposal indicate if the Alternate item is an: Addition or Deletion.
- 3.2 SCHEDULE OF ALTERNATES:
1. ALTERNATES #1: Provide installation of Removed sink (Key Note #8 on AD101) and install on South wall of Drawing Studio 507, include all cutting, patching, plumbing and finish work to locate drain and supply and install sink.
  2. END OF SECTION 012300

## SECTION 012500 - SUBSTITUTION PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Refer to Uniform the General Conditions, Section 8.3.5 and 8.3.6 for substitutions. The most stringent requirement between UGC and this section shall apply.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
  - 1. Section 016000 "Product Requirements" and UGC for requirements for submitting comparable product submittals for products by listed manufacturers.

#### 1.3 DEFINITIONS

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

#### 1.4 ACTION SUBMITTALS

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
    - b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.

- c. Detailed side by side comparison of the qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. The qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
  - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
  - e. Samples, where applicable or requested.
  - f. Certificates and qualification data, where applicable or requested.
  - g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
  - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated, only if specifically required.
  - i. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
  - j. Cost information, showing the cost reduction or no change to the contract amount.
  - k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, is appropriate for applications indicated and the Contractor accepts total responsibility for the performance of the substituted item or system.
  - l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven (7) days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within fifteen (15) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
  - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.
  - c. Architect's approval of substituting does not certify the performance of the material or system.

## 1.5 QUALITY ASSURANCE

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

## 1.6 PROCEDURES

- A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

## PART 2 - PRODUCTS

### 2.1 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than fifteen (15) days prior to time required for preparation and review of related submittals.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
    - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    - b. Requested substitution provides sustainable design characteristics that specified product provided.
    - c. Substitution request is fully documented and properly submitted.
    - d. Requested substitution will not adversely affect Contractor's construction schedule.
    - e. Requested substitution has received necessary approvals of authorities having jurisdiction.
    - f. Requested substitution is compatible with other portions of the Work.
    - g. Requested substitution has been coordinated with other portions of the Work.
    - h. Requested substitution provides specified warranty.
    - i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Architect will consider requests for substitution if received within thirty (30) days after the Notice to Proceed. Requests received after that time will not be considered.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
    - a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
    - b. Requested substitution does not require extensive revisions to the Contract Documents.
    - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    - d. Requested substitution provides sustainable design characteristics that specified product provided.
    - e. Substitution request is fully documented and properly submitted.
    - f. Requested substitution will not adversely affect Contractor's construction schedule.
    - g. Requested substitution has received necessary approvals of authorities having jurisdiction.

- h. Requested substitution is compatible with other portions of the Work.
- i. Requested substitution has been coordinated with other portions of the Work.
- j. Requested substitution provides specified warranty.
- k. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

## SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Refer to Uniform General Conditions, Article 11 for Change Order procedures. The most restrictive between the UGC and this section shall apply.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Requirements:
  - 1. Section 012500 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.
  - 2. Refer to UGC Article 11.8 for maximum allowable percentages for changes in the work.

#### 1.3 MINOR CHANGES IN THE WORK

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

#### 1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
  - 1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
  - 2. Within twenty (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 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
  - 7. Proposal Request Form: Use AIA Forms.

#### 1.5 CHANGE ORDER PROCEDURES

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

#### 1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Work Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work where the time or cost cannot be agreed upon. See General Conditions for detailed procedures, for subsequent inclusion in a Change Order.
  - 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
  - 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600



## SECTION 012900 - PAYMENT PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Refer to Uniform General Conditions, Article 10 for payment procedures that may differ from this section. The most restrictive of the two shall prevail.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
  - 1. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
  - 2. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

#### 1.3 DEFINITIONS

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

#### 1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
  - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
    - a. Application for Payment forms with continuation sheets.
    - b. Submittal schedule.
    - c. Items required to be indicated as separate activities in Contractor's construction schedule.
  - 2. Submit the schedule of values to Architect at earliest possible date, but no later than fourteen (14) 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 schedule of values consistent with format of AIA Document G703, 1992 Edition.
3. 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. Name of subcontractor.
  - d. Name of manufacturer or fabricator.
  - e. Name of supplier.
  - f. Change Orders (numbers) that affect value.
  - g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
    - 1) Labor.
    - 2) Materials.
    - 3) Equipment.
4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five (5%) percent of the Contract Sum but specifically for plumbing, mechanical and electrical. Provide a line item for each Specification Section.
5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
6. 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. No payment will be made for items stored off-site..
7. 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.
8. Allowances: Provide a separate line item in the schedule of values for each allowance.
9. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
  - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
10. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

#### 1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
  1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment Application Times: Submit Application for Payment to Architect by the 30<sup>th</sup> day of the month. The period covered by each Application for Payment is one month, ending on the 25<sup>th</sup> day of the month.
  - 1. Submit draft copy of Application for Payment seven (7) days prior to due date for review by Architect.
- D. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
  - 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
  - 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
  - 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
  - 4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.
- F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored at the site of construction, but not yet installed. No payment will be made for materials 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.
- G. Transmittal: Submit four (4) signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
  - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- 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.
  4. Schedule of unit prices.
  5. Submittal schedule.
  6. List of Contractor's staff assignments.
  7. List of all Sub Contractors and suppliers.
  8. Copies of building permits.
  9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
  10. Initial progress report.
  11. Report of preconstruction conference.
  12. Certificates of insurance and insurance policies.
  13. Performance and payment bonds.
- 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. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
  3. Updated final statement, accounting for final changes to the Contract Sum.
  4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
  5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
  6. AIA Document G707, "Consent of Surety to Final Payment."
  7. Evidence that claims have been settled.
  8. Final meter readings for utilities, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
  9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

## SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Refer to Uniform General Conditions for Pre-Construction Conference and general responsibilities.

#### 1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
  - 1. General coordination procedures.
  - 2. Coordination drawings.
  - 3. Requests for Information (RFIs).
  - 4. Project meetings.
- B. Related Requirements:
  - 1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
  - 2. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

#### 1.3 DEFINITIONS

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

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form, using Excel software:
  - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
  - 2. Number and title of related Specification Section(s) covered by subcontract.
  - 3. Drawing number and detail references, as appropriate, covered by subcontract.
- B. Key Personnel Names: Within 15 (fifteen) days of the Notice to Proceed, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses.



- C. Sub-Contractors: Within 15 (fifteen) days of the Notice to Proceed, submit a list of Sub-Contractors with the names of their key personnel assignments. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses.

## 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 to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
  - 1. Preparation of Contractor's construction schedule.
  - 2. Preparation of the schedule of values.
  - 3. Installation and removal of temporary facilities and controls.
  - 4. Delivery and processing of submittals.
  - 5. Progress meetings.
  - 6. Preinstallation conferences.
  - 7. Project closeout activities.
  - 8. Startup and adjustment of systems.
- C. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
  - 1. 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.

## 1.6 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
  - 1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

- a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
- b. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
- c. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
- d. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
- e. Indicate required installation sequences.
- f. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:
  - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
  - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
  - c. Fire-rated enclosures around ductwork.
7. Electrical Work: Show the following:
  - a. Runs of vertical and horizontal conduit 1-1/4 inches (32 mm) in diameter and larger.
  - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
  - c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
  - d. Location of pull boxes and junction boxes dimensioned from column center lines.
8. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared

in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.

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

#### 1.7 REQUESTS FOR INFORMATION (RFIs)

- A. General: After thorough examination of the Contract Documents it is discovered of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Architect.
6. 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: AIA Document G716 or Software-generated form with substantially the same content as indicated above, acceptable to Architect.

1. Attachments shall be electronic format to allow Architect to respond on the RFI or attachment.

- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven (7) working days, after receipt by the Architect, for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:
  - a. Requests for approval of submittals.
  - b. Requests for approval of substitutions.

- c. Requests for approval of Contractor's means and methods.
  - d. Requests for coordination information already indicated in the Contract Documents.
  - e. Requests for adjustments in the Contract Time or the Contract Sum.
  - f. Requests for interpretation of Architect's actions on submittals.
  - g. Incomplete RFIs or inaccurately prepared RFIs.
- 2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
- 3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."
  - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within ten (10) days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log at each project site meeting and with each Certificate of Payment. Software log in Excel 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 (7) days if Contractor disagrees with response.
  - 1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

## 1.8 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
  - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
  - 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
  - 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within five (5) 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 Contractor, but no later than fifteen (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. Tentative construction schedule.
    - b. Phasing.
    - c. Critical work sequencing and long-lead items.
    - d. Designation of key personnel and their duties.
    - e. Lines of communications.
    - f. Procedures for processing field decisions and Change Orders.
    - g. Procedures for RFIs.
    - h. Procedures for testing and inspecting.
    - i. Procedures for processing Applications for Payment.
    - j. Distribution of the Contract Documents.
    - k. Submittal procedures.
    - l. Preparation of record documents.
    - m. Use of the premises and existing building.
    - n. Work restrictions.
    - o. Working hours.
    - p. Owner's occupancy requirements.
    - q. Responsibility for temporary facilities and controls.
    - r. Procedures for moisture and mold control.
    - s. Procedures for disruptions and shutdowns.
    - t. Construction waste management and recycling.
    - u. Parking availability.
    - v. Office, work, and storage areas.
    - w. Equipment deliveries and priorities.
    - x. First aid.
    - y. Security.
    - z. Progress cleaning.
  3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Coordination Meetings: Project coordination meetings at weekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
  2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100



## SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Refer to the Uniform General Conditions, Article 9, for UGC schedule requirements. The most restrictive between the UGC and this section shall prevail.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
  - 1. Contractor's construction schedule.
  - 2. Construction schedule updating reports.
  - 3. Daily construction reports.
  - 4. Material location reports.
  - 5. Site condition reports.
  - 6. Special reports.
- B. Related Requirements:
  - 1. Section 013300 "Submittal Procedures" for submitting schedules and reports.
  - 2. Section 014000 "Quality Requirements" for submitting a schedule of tests and inspections.

#### 1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
  - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
  - 2. Predecessor Activity: An activity that precedes another activity in the network.
  - 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.
- C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.



- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- E. Event: The starting or ending point of an activity.
- F. Float: The measure of leeway in starting and completing an activity.
  - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
  - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
  - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- G. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
  - 1. PDF electronic file.
- B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
  - 1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.
- C. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
  - 1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
  - 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
  - 3. Total Float Report: List of all activities sorted in ascending order of total float.
- D. Construction Schedule Updating Reports: Submit with each Application for Payment. Payment Applications will NOT be processed without schedule update.
- E. Daily Construction Reports: Submit at monthly intervals with each Application for Payment.
- F. Material Location Reports: Submit at monthly intervals with each Application of Payment.
- G. Site Condition Reports: Submit at time of discovery of differing conditions.
- H. Special Reports: Submit at time of unusual event.

## 1.5 QUALITY ASSURANCE

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

## 1.6 COORDINATION

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

## PART 2 - PRODUCTS

### 2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

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

3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
  4. Startup and Testing Time: Include no fewer than fifteen (15) days for startup and testing.
  5. Substantial Completion: Indicate completion.
  6. Punch List and Final Completion: Include not more than thirty (30) days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Work by Owner: Include a separate activity for each portion of the Work performed by Owner, if any.
  2. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
  3. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
  4. Work Restrictions: Show the effect of the following items on the schedule:
    - a. Coordination with existing construction.
    - b. Limitations of continued occupancies.
    - c. Uninterruptible services.
    - d. Partial occupancy before Substantial Completion.
    - e. Use of premises restrictions.
    - f. Provisions for future construction.
    - g. Seasonal variations.
    - h. Environmental control.
  5. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
    - a. Subcontract awards.
    - b. Submittals.
    - c. Purchases.
    - d. Mockups.
    - e. Fabrication.
    - f. Sample testing.
    - g. Deliveries.
    - h. Installation.
    - i. Tests and inspections.
    - j. Adjusting.
    - k. Curing.
  6. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
    - a. Structural completion.
    - b. Temporary enclosure and space conditioning.
    - c. Permanent space enclosure.
    - d. Completion of mechanical installation.
    - e. Completion of electrical installation.
    - f. Substantial Completion.

- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.
- E. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.
  - 1. Use Microsoft Project, for operating system.

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

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. CPM Schedule: Prepare Contractor's construction schedule using a time-scaled CPM network analysis diagram for the Work.
  - 1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than sixty (60) days after date established for the Notice to Proceed.
    - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.
  - 2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
  - 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
  - 4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.
- C. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
  - 1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
    - a. Preparation and processing of submittals.
    - b. Mobilization and demobilization.
    - c. Purchase of materials.
    - d. Delivery.
    - e. Fabrication.
    - f. Utility interruptions.
    - g. Installation.
    - h. Work by Owner that may affect or be affected by Contractor's activities.
    - i. Testing.
    - j. Punch list and final completion.
    - k. Activities occurring following final completion.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
  3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
  4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
- D. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.
- E. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
1. Contractor or subcontractor and the Work or activity.
  2. Description of activity.
  3. Main events of activity.
  4. Immediate preceding and succeeding activities.
  5. Early and late start dates.
  6. Early and late finish dates.
  7. Activity duration in workdays.
  8. Total float or slack time.
- F. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
1. Identification of activities that have changed.
  2. Changes in early and late start dates.
  3. Changes in early and late finish dates.
  4. Changes in activity durations in workdays.
  5. Changes in the critical path.
  6. Changes in total float or slack time.
  7. Changes in the Contract Time.

## 2.3 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
  2. List of separate contractors at Project site.
  3. Approximate count of personnel at Project site.
  4. Equipment at Project site.
  5. Material deliveries.
  6. High and low temperatures and general weather conditions, including presence of rain or snow.
  7. Accidents.
  8. Meetings and significant decisions.
  9. Unusual events (see special reports).
  10. Stoppages, delays, shortages, and losses.
  11. Meter readings and similar recordings.

12. Emergency procedures.
  13. Orders and requests of authorities having jurisdiction.
  14. Change Orders received and implemented.
  15. Construction Change Directives received and implemented.
  16. Services connected and disconnected.
  17. Equipment or system tests and startups.
  18. Partial completions and occupancies.
  19. Substantial Completions authorized.
- B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:
1. Material stored prior to previous report and remaining in storage.
  2. Material stored prior to previous report and since removed from storage and installed.
  3. Material stored following previous report and remaining in storage.
- C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

## 2.4 SPECIAL REPORTS

- A. General: Submit special reports directly to Owner within one (1) day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

## PART 3 - EXECUTION

### 3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Scheduling Consultant: At the Contractor's option, engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.
1. In-House Option: Owner may waive the requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
  2. Meetings: Scheduling consultant or in-house scheduler shall attend all meetings related to Project progress, alleged delays, and time impact.
- B. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule before each regularly scheduled progress meeting with Certificate of Payment. Certificates of Payment will NOT be processed without an updated construction schedule.

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

END OF SECTION 013200

## SECTION 013300 - SUBMITTAL PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Refer to the Uniform General Conditions, Article 8, for Submittal Procedures. Where UGC and this section differ, the most restrictive shall prevail.

#### 1.2 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
  - 1. Section 012900 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
  - 2. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
  - 3. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
  - 4. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

#### 1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."
- C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.



#### 1.4 ACTION SUBMITTALS

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

#### 1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.
1. Architect will furnish Contractor limited digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.
    - a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
    - b. Digital Drawing Software Program: The Contract Drawings are available in Auto CAD DWG or PDF format.
    - c. The following digital data files will be furnished for each appropriate discipline:
      - 1) Floor plans.
      - 2) Reflected ceiling plans.
      - 3) Mechanical and Electrical electronic files will not be made available.
      - 4) Structural drawings will only be made available on a selected basis and with permission of the structural engineer.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
  3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
  4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
    - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow fifteen (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 fifteen (15) days for review of each resubmittal.
  4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow twenty-one (21) days for initial review of each submittal.
  5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow fifteen (15) days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
- D. Paper Submittals: Place a permanent label or title block on each submittal item for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
  2. Provide a space approximately 3" X 5" on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
  3. Include the following information for processing and recording action taken:
    - a. Project name.
    - b. Date.
    - c. Name of Architect.
    - d. Name of Construction Manager.
    - e. Name of Contractor.
    - f. Name of subcontractor.
    - g. Name of supplier.
    - h. Name of manufacturer.
    - i. Submittal number or other unique identifier, including revision identifier.
- 1) Submittal number shall use a sequential number for each submittal. For resubmittal shall have a suffix beginning with R1. For each additional resubmittal add R2, R3, etc. as necessary until approval is received.

- j. Number and title of appropriate Specification Section.
  - k. Drawing number and detail references, as appropriate.
4. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return without review submittals received from sources other than Contractor.
- a. Transmittal Form for Paper Submittals: Use form standard with Contractor.
  - b. Transmittal Form for Paper Submittals: Provide locations on form for the following information:
    - 1) Project name.
    - 2) Date.
    - 3) Destination (To:).
    - 4) Source (From:).
    - 5) Name and address of Architect.
    - 6) Name of Contractor.
    - 7) Name of firm or entity that prepared submittal.
    - 8) Names of subcontractor, manufacturer, and supplier.
    - 9) Category and type of submittal.
    - 10) Submittal purpose and description.
    - 11) Specification Section number and title.
    - 12) Specification paragraph number or drawing designation and generic name for each of multiple items.
    - 13) Drawing number and detail references, as appropriate.
    - 14) Indication of full or partial submittal.
    - 15) Transmittal number, numbered consecutively.
    - 16) Submittal and transmittal distribution record.
    - 17) Remarks.
    - 18) Signature of transmitter.
- E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
- 1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
  - 2. Name file with submittal number or other unique identifier, including revision identifier.
  - 3. Transmittal Form for Electronic Submittals: Use form acceptable to Architect, containing the following information:
    - a. Project name.
    - b. Date.
    - c. Name and address of Architect.
    - d. Name of Contractor.
    - e. Name of firm or entity that prepared submittal.
    - f. Names of subcontractor, manufacturer, and supplier.
    - g. Category and type of submittal.
    - h. Submittal purpose and description.
    - i. Specification Section number and title.
    - j. Specification paragraph number or drawing designation and generic name for each of multiple items.
    - k. Drawing number and detail references, as appropriate.
    - l. Location(s) where product is to be installed, as appropriate.
    - m. Related physical samples submitted directly.
    - n. Indication of full or partial submittal.

- o. Transmittal number, numbered consecutively.
  - p. Submittal and transmittal distribution record.
  - q. Other necessary identification.
  - r. Remarks.
- F. Options: Identify options requiring selection by Architect.
- G. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
  - 1. Note date and content of previous submittal.
  - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
  - 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- J. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

## PART 2 - PRODUCTS

### 2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
  - 1. For files larger than 2 megabytes post electronic submittals as PDF electronic files directly to Architect's email address or to "Transfer Big Files".
    - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
  - 2. For files 2 megabytes or smaller submit electronic submittals via email as PDF electronic files.
    - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
  - 3. Action Submittals: Submit two (2) paper copies of each submittal unless otherwise indicated. Architect will return one (1) copy.
  - 4. Informational Submittals: Submit two (2) paper copies of each submittal unless otherwise indicated. Architect will not return copies.

5. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
  1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
  2. Mark each copy of each submittal to show which products and options are applicable.
  3. Include the following information, as applicable:
    - a. Manufacturer's catalog cuts.
    - b. Manufacturer's product specifications.
    - c. Standard color charts.
    - d. Statement of compliance with specified referenced standards.
    - e. Testing by recognized testing agency.
    - f. Application of testing agency labels and seals.
    - g. Notation of coordination requirements.
    - h. Availability and delivery time information.
  4. For equipment, include the following in addition to the above, as applicable:
    - a. Wiring diagrams showing factory-installed wiring.
    - b. Printed performance curves.
    - c. Operational range diagrams.
    - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
  5. Submit Product Data before or concurrent with Samples.
  6. Submit Product Data in the following format:
    - a. PDF electronic file.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
  1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    - a. Identification of products.
    - b. Schedules.
    - c. Compliance with specified standards.
    - d. Notation of coordination requirements.
    - e. Notation of dimensions established by field measurement.
    - f. Relationship and attachment to adjoining construction clearly indicated.
    - g. Seal and signature of professional engineer if specified.
  2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 24 inches by 36 inches.
  3. Submit Shop Drawings in one of the following format:
    - a. PDF electronic file.

- b. One (1) opaque (bond) copy of each submittal only if not available in PDF format. Architect will return one (1) copy.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
  - 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
  - 2. Identification: Attach label on unexposed side of Samples that includes the following:
    - a. Generic description of Sample.
    - b. Product name and name of manufacturer.
    - c. Sample source.
    - d. Number and title of applicable Specification Section.
    - e. Specification paragraph number and generic name of each item.
  - 3. Samples for 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 (1) full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will indicate the option selected in color schedule.
- E. Coordination Drawing Submittals: Comply with requirements specified in Section 013100 "Project Management and Coordination."
- F. Contractor's Construction Schedule: Comply with requirements specified in Section 013200 "Construction Progress Documentation."
- G. Application for Payment and Schedule of Values: Comply with requirements specified in Section 012900 "Payment Procedures."
- H. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."
- I. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."
- J. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."
- K. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- L. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- M. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

- N. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- O. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- P. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- Q. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- R. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

### PART 3 - EXECUTION

#### 3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 017700 "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
- D. Should it become evident that the Contractor has not performed a thorough review, but rubber stamped and sent forward, the Architect shall return unchecked for the Contractor to provide a thorough review.

#### 3.2 ARCHITECT'S ACTION

- A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:
  - Approved – The work covered by the submittal may proceed provided it complies with the contract documents. Final acceptance will depend on that compliance.

- Approved As Noted – The work covered by the submittal may proceed provided it complies with both Architect's notations and corrections on the submittal and the contract documents. Final acceptance will depend on that compliance.
  - Not Approved – Revise and Resubmit – DO NOT proceed with the work covered by the submittal, including purchasing, fabrication, delivery, or other activity for the product submitted. Revise or prepare a new submittal according to the Architect's notations and corrections.
  - Rejected – DO NOT proceed with the work covered by the submittal. Prepare a new submittal for a product that complies with the contract documents.
- B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- C. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- D. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 013300





## SECTION 014000 - QUALITY REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 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.
- B. Refer to the Uniform General Conditions with emphasis on Article 8. Should UGC and these specifications differ, the most restrictive shall apply.

#### 1.2 SUMMARY

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

#### 1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified

installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

1. Laboratory Mockups: Full-size physical assemblies constructed at testing facility to verify performance characteristics.
  2. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
  3. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.
- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five (5) previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- 1.4 CONFLICTING REQUIREMENTS
- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as

appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Qualification Data : For Contractor's quality-control personnel.
- C. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- D. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
  - 1. Specification Section number and title.
  - 2. Entity responsible for performing tests and inspections.
  - 3. Description of test and inspection.
  - 4. Identification of applicable standards.
  - 5. Identification of test and inspection methods.
  - 6. Number of tests and inspections required.
  - 7. Time schedule or time span for tests and inspections.
  - 8. Requirements for obtaining samples.
  - 9. Unique characteristics of each quality-control service.

#### 1.6 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
  - 1. Date of issue.
  - 2. Project title and number.
  - 3. Name, address, and telephone number of testing agency.
  - 4. Dates and locations of samples and tests or inspections.
  - 5. Names of individuals making tests and inspections.
  - 6. Description of the Work and test and inspection method.
  - 7. Identification of product and Specification Section.
  - 8. Complete test or inspection data.
  - 9. Test and inspection results and an interpretation of test results.
  - 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
  - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
  - 12. Name and signature of laboratory inspector.
  - 13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
  - 1. Name, address, and telephone number of technical representative making report.
  - 2. Statement on condition of substrates and their acceptability for installation of product.

3. Statement that products at Project site comply with requirements.
  4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
  5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  6. Statement whether conditions, products, and installation will affect warranty.
  7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of factory-authorized service representative making report.
  2. Statement that equipment complies with requirements.
  3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  4. Statement whether conditions, products, and installation will affect warranty.
  5. Other required items indicated in individual Specification Sections.
- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

#### 1.7 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in Texas, 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 products that are similar in material, design, and extent to those indicated for this Project.
- F. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.

2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- G. 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.
- H. 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.
- I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
1. Contractor responsibilities include the following:
    - a. Provide test specimens representative of proposed products and construction.
    - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
    - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
    - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
    - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
    - f. When testing is complete, remove test specimens, assemblies, mockups; do not reuse products on Project.
    - g. Contractor shall pay for all tests to show compliance with Contract Documents.
  2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
  2. Notify Architect seven (7) days in advance of dates and times when mockups will be constructed.
  3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction at Project.
  4. Demonstrate the proposed range of aesthetic effects and workmanship.
  5. Obtain Architect's and Owner's approval of mockups before starting work, fabrication, or construction.
  6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  7. Demolish and remove mockups when directed unless otherwise indicated.

1.8 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
  - 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
  - 2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
  - 3. In general the Owner will pay for On-Site testing. Tests required to prove materials are acceptable for the project and responsibility of the Contractor.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
  - 1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
  - 2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
    - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
  - 3. Notify testing agencies at least twenty-four (24) hours in advance of time when Work that requires testing or inspecting will be performed.
  - 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
  - 5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  - 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."
- D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- F. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
  - 1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
  3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
  4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
  5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
  6. Do not perform any duties of Contractor.
- G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
  2. Incidental labor and facilities necessary to facilitate tests and inspections.
  3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
  4. Facilities for storage and field curing of test samples.
  5. Delivery of samples to testing agencies.
  6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  7. Security and protection for samples and for testing and inspecting equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.
1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible



as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

## SECTION 014200 - REFERENCES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 DEFINITIONS

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

#### 1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

- 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

#### 1.4 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

## SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Refer to the Uniform General Conditions for Additional Requirements, specifically refer to Article 8. Where UGC and these specifications differ the most stringent shall prevail.

#### 1.2 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
  - 1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.

#### 1.3 USE CHARGES

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

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
- B. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
  - 1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
  - 2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.

3. Indicate sequencing of work that requires water, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
- C. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
  1. Locations of dust-control partitions at each phase of work.
  2. HVAC system isolation schematic drawing.
  3. Location of proposed air-filtration system discharge.
  4. Waste handling procedures.
  5. Other dust-control measures.

## 1.5 QUALITY ASSURANCE

- A. 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.

## 1.6 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 MATERIALS

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

### 2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

## 2.3 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 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.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

### 3.2 TEMPORARY UTILITY INSTALLATION

- A. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
  - 1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.
    - a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
  - 2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
  - 3. Perform daily construction cleanup and final cleanup.
- B. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
  - 1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.
- C. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

- D. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
  - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- E. Telephone Service: Provide temporary telephone service in Field Office for use by all construction personnel.
  - 1. Provide additional telephone lines for the following:
    - a. Provide a dedicated telephone line for each facsimile machine in each field office.
  - 2. At each telephone, post a list of important telephone numbers.
    - a. Police and fire departments.
    - b. Ambulance service.
    - c. Contractor's home office.
    - d. Contractor's emergency after-hours telephone number.
    - e. Architect's office.
    - f. Engineers' offices.
    - g. Owner's office.
    - h. Principal subcontractors' field and home offices.
  - 3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.
- F. Electronic Communication Service: Provide a desktop computer in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications.

### 3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
  - 1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
  - 2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. 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.
  - 3. Maintain and touchup signs so they are legible at all times.
- C. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 017300 "Execution."

- D. Lifts and Hoists: Provide facilities necessary for hoisting materials.
  - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- E. Existing Elevator Use: Use of Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.
  - 1. Do not load elevators beyond their rated weight capacity.
  - 2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.
- F. 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.

### 3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
  - 1. Comply with work restrictions specified in Section 011000 "Summary."
- C. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.
  - 1. Construct dustproof partitions with two layers of 6-mil (0.14-mm) polyethylene sheet on each side. Cover floor with two layers of 6-mil (0.14-mm) polyethylene sheet, extending sheets 18 inches (460 mm) up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.
    - a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches (1219 mm) between doors. Maintain water-dampened foot mats in vestibule.
  - 2. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
  - 3. Insulate partitions to control noise transmission to occupied areas.
  - 4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
  - 5. Protect air-handling equipment.
  - 6. Provide walk-off mats at each entrance through temporary partition.



- D. 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.
  - 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
  - 3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

### 3.5 MOISTURE AND MOLD CONTROL

- A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.
- B. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
  - 1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
  - 2. Use permanent HVAC system to control humidity.
  - 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
    - a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for forty-eight (48) hours are considered defective.
    - b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for forty-eight (48) hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
    - c. Remove materials that cannot be completely restored to their manufactured moisture level within forty-eight (48) hours.

### 3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
  - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.
- D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- E. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than

Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

END OF SECTION 015000



## SECTION 016000 - PRODUCT REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Refer to the total Uniform General Conditions, specifically Article 8 for requirements. Where UGC and these specifications differ, the more stringent shall apply.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
  - 1. Section 012500 "Substitution Procedures" for requests for substitutions.
  - 2. Section 014200 "References" for applicable industry standards for products specified.

#### 1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
  - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
  - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
  - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

#### 1.4 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
  - 2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within fifteen (15) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.
    - a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
    - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

#### 1.5 QUALITY ASSURANCE

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

#### 1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
  - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
  - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
  - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
  - 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.
7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

#### 1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
- B. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

### PART 2 - PRODUCTS

#### 2.1 PRODUCT SELECTION PROCEDURES

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

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

## 2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000





## SECTION 017300 - EXECUTION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Refer to the Uniform General Conditions where requirements differ from these specifications, the more restrictive shall apply.

#### 1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
  - 1. Installation of the Work.
  - 2. Cutting and patching.
  - 3. Progress cleaning.
  - 4. Starting and adjusting.
  - 5. Protection of installed construction.
  - 6. Correction of the Work.
- B. Related Requirements:
  - 1. Section 013300 "Submittal Procedures" for submitting surveys.
  - 2. Section 017700 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

#### 1.3 DEFINITIONS

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

#### 1.4 QUALITY ASSURANCE

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

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. Retain subparagraph below for LEED projects and projects with specific sustainable design requirements that may affect Contractor selection of materials used in patching.
- C. 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. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
  - 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  - 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  - 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- B. 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.
- C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. 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.
- B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 013100 "Project Management and Coordination."

### 3.3 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  - 1. Make vertical work plumb and make horizontal work level.
  - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
  - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
  - 2. Allow for building movement, including thermal expansion and contraction.
  - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

### 3.4 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 011000 "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. Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  - 4. 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.
  - 5. 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.

### 3.5 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 (27 deg C).
  3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
    - a. Use containers intended for holding waste materials of type to be stored.
  4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
  1. Remove liquid spills promptly.
  2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls." Section 017419 "Construction Waste Management and Disposal."
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### 3.6 STARTING AND ADJUSTING

- A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."
- B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

### 3.7 PROTECTION OF INSTALLED CONSTRUCTION

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

END OF SECTION 017300





## SECTION 017700 - CLOSEOUT PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Refer to the total Uniform General Conditions, but specifically Article 12. Where the UGC and these specifications vary, the most restrictive shall apply.

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

#### 1.3 ACTION SUBMITTALS

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

#### 1.4 CLOSEOUT SUBMITTALS

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

1.5 MAINTENANCE MATERIAL SUBMITTALS

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

1.6 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of ten (10) days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.
  - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.

5. Submit test/adjust/balance records.

- C. Procedures Prior to Substantial Completion: Complete the following a minimum of ten (10) days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
6. Advise Owner of changeover in heat and other utilities.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements, including touchup painting.

10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of ten (10) days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
  1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
  2. Results of completed inspection will form the basis of requirements for final completion.

#### 1.7 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
  1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
  2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
  3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  4. Submit pest-control final inspection report.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
  1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

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

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
  1. Organize list of spaces in sequential order.
  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 or MS Word electronic file. Architect will return annotated file.

## 1.9 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within fifteen(15) days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
  - 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, **RED** in color, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (215-by-280-mm) paper.
  - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
  - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
  - 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- D. 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.

## PART 3 - EXECUTION

### 3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
  - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
    - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
    - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    - e. Remove snow and ice to provide safe access to building.
    - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    - h. Sweep concrete floors broom clean in unoccupied spaces.
    - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
    - j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
    - k. Remove labels that are not permanent.
    - l. Wipe surfaces of mechanical and electrical equipment 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.
      - 1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.
    - p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
    - q. Leave Project clean and ready for occupancy.

- C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."

### 3.2 REPAIR OF THE WORK

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

END OF SECTION 017700

## SECTION 017823 - OPERATION AND MAINTENANCE DATA

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. Refer to the Uniform General Conditions for Project Completion and Warranty and Guarantee requirements.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Operation and maintenance documentation directory.
  - 2. Operation manuals for systems, subsystems, and equipment.
  - 3. Product maintenance manuals.
  - 4. Systems and equipment maintenance manuals.
- B. Related Requirements:
  - 1. Section 013300 "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. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
  - 1. Architect will comment on whether content of operations and maintenance submittals are acceptable.
  - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:
  - 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.



- a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
  - b. Enable inserted reviewer comments on draft submittals.
2. Three (3) paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Architect will return two (2) copies.
- C. Initial Manual Submittal: Submit draft copy of each manual at least thirty (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 fifteen (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 fifteen (15) days of receipt of Architect's comments and prior to commencing demonstration and training.

## PART 2 - PRODUCTS

### 2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
  1. List of documents.
  2. List of systems.
  3. List of equipment.
  4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

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

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
  - 1. Title page.
  - 2. Table of contents.
  - 3. Manual contents.
- B. Title Page: Include the following information:
  - 1. Subject matter included in manual.
  - 2. Name and address of Project.
  - 3. Name and address of Owner.
  - 4. Date of submittal.
  - 5. Name and contact information for Contractor.
  - 6. Name and contact information for 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. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
  - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
  - 2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
  - 1. Binders: Heavy-duty, three-ring, vinyl-covered, **RED** in color, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch (215-by-

280-mm) paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

- a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
  - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, subject matter of contents. Indicate volume number for multiple-volume sets.
2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
  3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
  4. Supplementary Text: Prepared on 8-1/2-by-11-inch (215-by-280-mm) white bond paper.
  5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
    - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

## 2.3 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
  1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
  2. Performance and design criteria if Contractor has delegated design responsibility.
  3. Operating standards.
  4. Operating procedures.
  5. Operating logs.
  6. Wiring diagrams.
  7. Control diagrams.
  8. Piped system diagrams.
  9. Precautions against improper use.
  10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
  1. Product name and model number. Use designations for products indicated on Contract Documents.
  2. Manufacturer's name.
  3. Equipment identification with serial number of each component.
  4. Equipment function.
  5. Operating characteristics.
  6. Limiting conditions.
  7. Performance curves.

8. Engineering data and tests.
  9. Complete nomenclature and number of replacement parts.
- C. Operating Procedures: Include the following, as applicable:
1. Startup procedures.
  2. Equipment or system break-in procedures.
  3. Routine and normal operating instructions.
  4. Regulation and control procedures.
  5. Instructions on stopping.
  6. Normal shutdown instructions.
  7. Seasonal and weekend operating instructions.
  8. Required sequences for electric or electronic systems.
  9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

## 2.4 PRODUCT MAINTENANCE MANUALS

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Product Information: Include the following, as applicable:
1. Product name and model number.
  2. Manufacturer's name.
  3. Color, pattern, and texture.
  4. Material and chemical composition.
  5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
1. Inspection procedures.
  2. Types of cleaning agents to be used and methods of cleaning.
  3. List of cleaning agents and methods of cleaning detrimental to product.
  4. Schedule for routine cleaning and maintenance.
  5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

## 2.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
  1. Standard maintenance instructions and bulletins.
  2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
  3. Identification and nomenclature of parts and components.
  4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
  1. Test and inspection instructions.
  2. Troubleshooting guide.
  3. Precautions against improper maintenance.
  4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  5. Aligning, adjusting, and checking instructions.
  6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
  1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
  2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
  1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
- B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
  - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
  - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
  - 1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.
  - 1. Do not use original project record documents as part of operation and maintenance manuals.
  - 2. Comply with requirements of newly prepared record Drawings in Section 017839 "Project Record Documents."
- F. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823



## SECTION 017839 - PROJECT RECORD DOCUMENTS

### PART 1 - GENERAL

#### 1.1 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.
- B. Refer to the Uniform General Conditions in total with emphasis on Article 6. This specification shall take precedence over UGC.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
  - 1. Record Drawings.
  - 2. Record Specifications.
  - 3. Record Product Data.
  - 4. Miscellaneous record submittals.
- B. Related Requirements:
  - 1. Section 017300 "Execution" for final property survey.
  - 2. Section 017700 "Closeout Procedures" for general closeout procedures.
  - 3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.

#### 1.3 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
  - 1. Number of Copies: Submit one (1) set(s) of marked-up record prints.
  - 2. Number of Copies: Submit copies of record Drawings as follows:
    - a. Initial Submittal:
      - 1) Submit one (1) paper-copy set(s) of marked-up record prints.
      - 2) Submit PDF electronic files of scanned record prints and one (1) of file prints.
      - 3) Submit record digital data files and one (1) set(s) of plots.
      - 4) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
    - b. Final Submittal:
      - 1) Submit three (3) paper-copy set(s) of marked-up record prints.
      - 2) Submit PDF electronic files of scanned record prints and three (3) set(s) of prints.



- 3) Print each drawing, whether or not changes and additional information were recorded.
- c. Final Submittal:
  - 1) Submit three (3) paper-copy set(s) of marked-up record prints.
  - 2) Submit record digital data files and three (3) set(s) of record digital data file plots.
  - 3) Plot each drawing file, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit one (1) paper copy and annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one (1) paper copy and annotated PDF electronic files and directories of each submittal.
  1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit three (3) paper copies and annotated PDF electronic files and directories of each submittal.
- E. Reports: Submit written report weekly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

## PART 2 - PRODUCTS

### 2.1 RECORD DRAWINGS

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

- d. Locations and depths of underground utilities.
  - e. Revisions to routing of piping and conduits.
  - f. Revisions to electrical circuitry.
  - g. Actual equipment locations.
  - h. Duct size and routing.
  - i. Locations of concealed internal utilities.
  - j. Changes made by Change Order or Change Directive.
  - k. Changes made following Architect's written orders.
  - l. Details not on the original Contract Drawings.
  - m. Field records for variable and concealed conditions.
  - n. Record information on the Work that is shown only schematically.
3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
  4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
  5. Mark important additional information that was either shown schematically or omitted from original Drawings.
  6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
  2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
  2. Format: Annotated PDF electronic file with comment function enabled.
  3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
  4. Identification: As follows:
    - a. Project name.
    - b. Date.
    - c. Designation "PROJECT RECORD DRAWINGS."
    - d. Name of Architect.
    - e. Name of Contractor.

## 2.2 RECORD SPECIFICATIONS

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

## 2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
  - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  - 3. Note related Change Orders, in record Specifications, and on record Drawings where applicable.

## 2.4 MISCELLANEOUS RECORD SUBMITTALS

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

## PART 3 - EXECUTION

### 3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 017839



## SECTION 017900 - DEMONSTRATION AND TRAINING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.
- B. The Uniform General Conditions are a part of the Contract Document. Where they differ from these specifications, the more restrictive shall prevail.

#### 1.2 SUMMARY

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

#### 1.3 INFORMATIONAL SUBMITTALS

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

#### 1.4 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two (2) copies within seven (7) days of end of each training module.
  - 1. Identification: On each copy, provide an applied label with the following information:
    - a. Name of Project.
    - b. Name and address of videographer.
    - c. Name of Architect.
    - d. Name of Construction Manager.

- e. Name of Contractor.
  - f. Date of video recording.
- 2. Transcript: Prepared and bound in format matching operation and maintenance manuals. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as the corresponding video recording. Include name of Project and date of video recording on each page. In addition provide a PDF in electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
  - 3. At completion of training, submit complete training manual(s) for Owner's use prepared and bound in format matching operation and maintenance manuals and in PDF electronic file format on compact disc.

#### 1.5 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.
- B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.
- C. Videographer Qualifications: A professional videographer who is experienced photographing demonstration and training events similar to those required.
- D. Preinstruction Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to demonstration and training including, but not limited to, the following:
  - 1. Inspect and discuss locations and other facilities required for instruction.
  - 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
  - 3. Review required content of instruction.
  - 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

#### 1.6 COORDINATION

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

## PART 2 - PRODUCTS

### 2.1 INSTRUCTION PROGRAM

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



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

### PART 3 - EXECUTION

#### 3.1 PREPARATION

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

#### 3.2 INSTRUCTION

- A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

- B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
  - 1. 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 (7) 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.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of an oral performance-based test.
- F. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

### 3.3 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

- A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.
  - 1. At beginning of each training module, record each chart containing learning objective and lesson outline.
- B. Video: Provide minimum 640 x 480 video resolution converted to format file type acceptable to Owner, on electronic media.
  - 1. Electronic Media: Read-only format compact disc acceptable to Owner, with commercial-grade graphic label.
  - 2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.
  - 3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.
  - 4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:
    - a. Name of Contractor/Installer.
    - b. Business address.
    - c. Business phone number.
    - d. Point of contact.
    - e. E-mail address.

- C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.
  - 1. Film training session(s) in segments not to exceed 15 minutes.
    - a. Produce segments to present a single significant piece of equipment per segment.
    - b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
    - c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.
- D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.
  - 1. Furnish additional portable lighting as required.
- E. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed.
- F. Transcript: Provide a transcript of the narration. Display images and running time captured from videotape opposite the corresponding narration segment.
- G. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION 017900

## SECTION 024119 - SELECTIVE 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 selected portions of building or structure.
  - 2. Demolition and removal of selected site elements.
  - 3. Salvage of existing items to be reused or recycled.

- B. Related Requirements:

- 1. Section 011000 "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
  - 2. Section 015639 "Temporary Tree and Plant Protection" for temporary protection of existing trees and plants that are affected by selective demolition.
  - 3. Section 017300 "Execution" for cutting and patching procedures.
  - 4. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade 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 or removed and reinstalled.
- B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.
- 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.

## 1.5 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site at date prior to commencement of demolition operations.
  - 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, including but not limited to, roof and clearstory on existing building.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property for dust control and, for noise control. Indicate proposed locations and construction of barriers.
- B. Schedule of Selective Demolition Activities: Indicate the following:
  - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
  - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
  - 3. Coordination for shutoff, capping, and continuation of utility services.
  - 4. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
- C. Predemolition Photographs: Submit before Work begins. Carefully and completely document any existing damage to existing structure.
- D. Warranties: Documentation indicated that existing warranties are still in effect after completion of selective demolition.

## 1.7 CLOSEOUT SUBMITTALS

- A. Inventory: Submit a list of items that have been removed and salvaged.

## 1.8 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
  - 1. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
  - 1. Maintain fire-protection facilities in service during selective demolition operations.
  - 2. Utilities service may not be interrupted during normal MSU hours of operation. Schedule interruptions at night or weekend.

## 1.9 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties if any.
- B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

## 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. Request and review record documents of existing construction available through the Architect. 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 preconstruction photographs.
  - 1. Comply with requirements specified in Section 013233 "Photographic Documentation."
  - 2. Inventory and record the condition of items to be removed and salvaged. Provide photographs of conditions that might be misconstrued as damage caused by salvage operations.
  - 3. 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. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
  - 1. Comply with requirements for existing services/systems interruptions specified in Section 011000 "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. Owner will arrange to shut off indicated services/systems when requested by Contractor.
  - 2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
  - 3. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated to be removed.
    - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
    - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
- C. Refrigerant: Where refrigerant is in a system to be demolished, remove refrigerant from mechanical equipment to be demolished according to 40 CFR 82 and regulations of authorities having jurisdiction.

### 3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Comply with requirements for access and protection specified in Section 015000 "Temporary Facilities and Controls."
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
  - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
  - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
  - 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
  - 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."
- 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; comply with requirements in Section 017419 "Construction Waste Management and Disposal."
- B. Reuse of Building Elements: Project has been designed to result in end-of-Project rates for reuse of building elements as follows. Do not demolish building elements beyond what is indicated on Drawings without Architect's approval.
- C. Removed and Salvaged Items:
1. Clean salvaged items.
  2. Pack or crate items after cleaning. Identify contents of containers.
  3. Store items in a secure area until delivery to Owner.
  4. Transport items to Owner's storage area off-site as designated by Owner.
  5. Protect items from damage during transport and storage.
- D. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse.
  2. Pack or crate items after cleaning and repairing. Identify contents of containers.
  3. Protect items from damage during transport and storage.
  4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

### 3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.
- 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. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.
- D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCL's "Recommended Work Practices for the Removal of Resilient Floor Coverings.
- E. 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 Roofing Section for new roofing requirements.

1. Remove portions of existing roof membrane, flashings, copings, and roof accessories.

### 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.
  4. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

### 3.7 CLEANING

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

END OF SECTION 024119



## SECTION 033000 - CAST-IN-PLACE CONCRETE

### 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 cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
  - 1. Slabs-on-grade – Repair and infill.
- B. Related Sections:
  - 1. Section 312000 "Earth Moving" for drainage fill under slabs-on-grade.
  - 2. Section 321313 "Concrete Paving" for concrete pavement and walks.

#### 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. LEED Submittals:
  - 1. Product Data for liquid floor treatments and curing and sealing compounds, documentation including printed statement of VOC content.
  - 2. Design Mixtures for each concrete mixture containing fly ash as a replacement for portland cement or other portland cement replacements, and for equivalent concrete mixtures that do not contain portland cement replacements.
- C. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- D. 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.
- E. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
  - 1. Location of construction joints is subject to approval of the Architect.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and/or manufacturer.
- B. Welding certificates.
- C. 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. Bonding agents.
  - 8. Adhesives.
  - 9. Vapor retarders.
  - 10. Joint-filler strips.
- D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
  - 1. Aggregates, both coarse and fine.
- E. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- F. 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.
  - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
  - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
- 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. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M, "Structural Welding Code - Reinforcing Steel."

- E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
  - 1. ACI 301, "Specifications for Structural Concrete.
  - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- G. Preinstallation Conference: Conduct conference at Project site.
  - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
    - a. Contractor's superintendent.
    - b. Independent testing agency responsible for concrete design mixtures.
    - c. Ready-mix concrete manufacturer.
    - d. Concrete subcontractor.
    - e. Special concrete finish subcontractor.

## 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.
  - 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. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
    - b. Structural 1, B-B or better; mill oiled and edge sealed.
    - c. 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. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

- D. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- E. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch minimum.
- F. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- G. 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.
- H. 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. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than twenty-five (25) percent.
- B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 deformed.
- C. Plain-Steel Wire: ASTM A 82/A 82M.
- D. Deformed-Steel Wire: ASTM A 496/A 496M.
- 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. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.
- 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 or plastic chair 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, Gray.
    - a. Fly Ash: ASTM C 618, Class for up to a maximum of 20% by weight.
- B. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded. Provide aggregates from a single source.
  - 1. Maximum Coarse-Aggregate Size: 1 inch.
  - 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. High-Range, Water-Reducing Admixture: ASTM C 494/C494/M, Type F.

## 2.6 VAPOR RETARDERS

- A. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 15 mils thick, permeance of 0.01 perms per ASTM F1249 and ASTM E96.
- B. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch sieve, 10 to 30 percent passing a No. 100 sieve, and at least 5 percent passing No. 200 sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

## 2.7 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 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.

## 2.8 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. ChemMasters; SprayFilm.
    - b. Euclid Chemical Company (The), an RPM company; Eucobar.
    - c. L&M Construction Chemicals, Inc.; E-CON.
    - d. Meadows, W. R., Inc.; EVAPRE.
    - e. Sika Corporation; SikaFilm.
    - f. Symons by Dayton Superior; Finishing Aid.
- B. Water: Potable.
- C. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
  - 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; Safe-Cure Clear.
    - b. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
    - c. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
    - d. L&M Construction Chemicals, Inc.; L&M Cure R.
    - e. Meadows, W. R., Inc.; 1100-CLEAR.
    - f. Symons by Dayton Superior; Resi-Chem Clear.

## 2.9 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber ASTM D 1752, cork or self-expanding cork.
- B. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. 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.
- D. Reglets: Fabricate reglets of not less than 0.022-inch thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

- 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.

## 2.10 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.

## 2.11 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, which would otherwise be used, by not more than 20 percent by weight, of cementitious materials other than portland cement in concrete as follows:
  - 1. Fly Ash: 20 percent.
  - 2. Combined Fly Ash and Pozzolan: 25 percent.
- C. Admixtures: Use admixtures according to manufacturer's written instructions.
  - 1. Use water-reducing 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.

## 2.12 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. All Concrete: Proportion normal-weight concrete mixture as follows:

1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Slump Limit: 4 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
3. Air Content: Between 4 and 6 percent, at point of delivery nominal maximum aggregate size.

## 2.13 FABRICATING REINFORCEMENT

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

## 2.14 CONCRETE MIXING

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

- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd. increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

## 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.

1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
  2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- 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 SHORES AND RESHORES

- A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

### 3.5 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.

### 3.6 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.

### 3.7 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. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
  - 4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
  - 5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
  - 6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
  - 7. 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 079200 "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.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

### 3.8 WATERSTOPS

- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.
- B. 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.

### 3.9 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. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 and as approved by the testing agency representative on site.
  - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- 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.

3.10 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.
- 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.
- C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
  1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

3.11 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. 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 indicated.
  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.
3. Finish and measure surface so gap at any point between concrete surface and an unveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/8 inch.

### 3.12 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: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

### 3.13 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 (1 kg/sq. m 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 one of 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.
  - d. Curing compound.
2. 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.

### 3.14 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.

### 3.15 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a special inspector 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. Steel reinforcement welding.
  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 before removal of shores and forms from beams and slabs.
- 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; ASTM C 173/C 173M, volumetric method; 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. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
7. Compression Test Specimens: ASTM C 31/C 31M.
  - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
  - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
8. 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.
9. 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.
10. 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.
11. 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.
12. 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.
13. 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.

14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

- E. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

### 3.16 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.

END OF SECTION 033000

## SECTION 061000 - ROUGH CARPENTRY

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Framing with dimension lumber.
- 2. Framing with timber.
- 3. Framing with engineered wood products.
- 4. Shear wall panels.
- 5. 1 x 2 wood trim; paint grade in sound control practice rooms.
- 6. 1 x 4 wood trim; paint grade at base in sound control practice rooms.
- 7. Wood blocking nailers.
- 8. Wood furring.
- 9. Wood sleepers.

- B. Related Requirements:

- 1. Section 313116 "Termite Control" for site application of borate treatment to wood framing.

#### 1.3 DEFINITIONS

- A. Exposed Framing: Framing not concealed by other construction.
- B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
- C. Lumber grading agencies, and the abbreviations used to reference them, include the following:
  - 1. NeLMA: Northeastern Lumber Manufacturers' Association.
  - 2. NLGA: National Lumber Grades Authority.
  - 3. RIS: Redwood Inspection Service.
  - 4. SPIB: The Southern Pine Inspection Bureau.
  - 5. WCLIB: West Coast Lumber Inspection Bureau.
  - 6. WWSA: Western Wood Products Association.

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

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- B. Evaluation Reports: For the following, from ICC-ES:
  1. Wood-preservative-treated wood.
  2. Fire-retardant-treated wood.
  3. Power-driven fasteners.
  4. Powder-actuated fasteners.
  5. Expansion anchors.

#### 1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

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

### PART 2 - PRODUCTS

#### 2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
4. Provide dressed lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber: 15 percent.

C. Engineered Wood Products: Provide engineered wood products acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable Design Stresses: Provide engineered wood products with allowable design stresses, as published by manufacturer, that meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

## 2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWP A U1.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
2. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

1. For exposed lumber indicated to receive a stained or natural finish, omit marking and provide certificates of treatment compliance issued by inspection agency.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood 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. Rooftop equipment bases and support curbs.
  - 4. Cants.
  - 5. Furring.
  - 6. Grounds.
  - 7. Utility shelving.
  - 8. Wall Door Stops.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber of any species.
- C. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:
  - 1. Mixed southern pine; No. 2 grade; SPIB.
  - 2. Hem-fir or hem-fir (north); Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
  - 3. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
  - 4. Eastern softwoods; No. 2 Common grade; NeLMA.
  - 5. Northern species; No. 2 Common grade; NLGA.
  - 6. Western woods; Construction or No. 2 Common grade; WCLIB or WWPA.
- D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

## 2.4 PLYWOOD BACKING PANELS

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

## 2.5 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Where rough 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. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1.
- F. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
  1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
  2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

## 2.6 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- B. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels.
- E. Shear Wall Panels: Install shear wall panels to comply with manufacturer's written instructions.

- F. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- G. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.
- H. Do not splice structural members between supports unless otherwise indicated.
- I. 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.
- J. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- K. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
  - 1. Use inorganic boron for items that are continuously protected from liquid water.
  - 2. Use copper naphthenate for items not continuously protected from liquid water.
- L. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. NES NER-272 for power-driven fasteners.
  - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
  - 3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
- M. 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.
- N. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
  - 1. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

### 3.2 WOOD BLOCKING, AND NAILER INSTALLATION

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

- C. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- D. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

### 3.3 WOOD FURRING INSTALLATION

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
- B. Furring to Receive Plywood or Hardboard Paneling: Install 1-by-3-inch nominal- size furring vertically at 24 inches o.c.
- C. Furring to Receive Gypsum Board: Install 1-by-2-inch nominal- size furring vertically at 16 inches o.c.

### 3.4 PROTECTION

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

END OF SECTION 061000



## SECTION 072100 - THERMAL INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Glass-fiber blanket insulation.
  - 2. Sound Wall insulation, batt and board.
- B. Related Sections:
  - 1. Section 061600 "Sheathing" for sheathing over wood or steel framing.

#### 1.3 ACTION SUBMITTALS

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

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each product.

#### 1.5 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

#### 1.6 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.

## PART 2 - PRODUCTS

### 2.1 GLASS-FIBER BLANKET INSULATION

- 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. CertainTeed Corporation.
  - 2. Johns Manville.
  - 3. Owens Corning.
- B. Unfaced, Glass-Fiber Blanket Insulation: 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.
- C. Kraft-Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type II (non-reflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier).
- D. Sustainability Requirements: Provide glass-fiber blanket insulation as follows:
  - 1. Low Emitting: Insulation tested according to ASTM D 5116 and shown to emit less than 0.05-ppm formaldehyde.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Clean substrates of substances that are harmful to insulation or that interfere with insulation attachment.

### 3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.
- 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. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

### 3.3 INSTALLATION OF INSULATION FOR FRAMED CONSTRUCTION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Glass-Fiber 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 metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- C. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation:

### 3.4 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

- A. Where glass-fiber blankets are indicated for sound attenuation above ceilings, install blanket insulation over entire ceiling area in thicknesses indicated. Extend insulation 48 inches up either side of partitions.

### 3.5 PROTECTION

- A. Protect installed insulation and vapor retarders 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.

### 3.6 INSULATION SCHEDULE

- A. Stud Wall Insulation: Width to fill stud space. If exact depth is not available, use next larger thickness.
  - 1. 8" for 8" studs – R Value of 25.
  - 2. 4" for 3/58" and 4" studs – R Value of 15.
  - 3. 3 ½" for insulation above lay-in ceilings – R Value 11.
  - 4. 6" insulation weaved in-between studs for Acoustical Sound deadening walls. Reference Architectural Detail A301-02. Full cavity of wall is to be "stuffed" full.
  - 5. 1" Duct Board, foil or vinyl faced to be installed over Gyp Board at all practice Rooms.

END OF SECTION 072100





## SECTION 072700 - FIRESTOPPING

### 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 firestopping for the following:
  - 1. Penetrations through fire-resistance-rated walls and partitions including both empty openings and openings containing cables, pipes, ducts, conduits, and other penetrating items.
  - 2. Penetrations through smoke barriers and construction enclosing compartmentalized areas involving both empty openings and openings containing penetrating items.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 4 Section "Unit Masonry" for joint fillers for non-fire-resistive-rated masonry construction.
  - 2. Division 15 Sections specifying ducts and piping penetrations.
  - 3. Division 16 Sections specifying cable and conduit penetrations.

#### 1.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. General: Provide firestopping systems that are produced and installed to resist the spread of fire, according to requirements indicated, and the passage of smoke and other gases.
- B. Fire-Resistive Joint Sealants: Provide joint sealants with fire-resistance ratings indicated, as determined per ASTM E 119, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs.

#### 1.4 SUBMITTALS

- A. General: Submit the following according to Conditions of Contract and Division 1 Specification Sections.
- B. Product data for each type of product specified.
  - 1. Certification by firestopping manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs) and are nontoxic to building occupants.
- C. Shop drawings detailing materials, installation methods, and relationships to adjoining construction for each through-penetration firestop system, and each kind of construction condition penetrated and kind of penetrating item. Include firestop design designation of qualified testing and inspecting agency evidencing compliance with requirements for each condition indicated.

1. Submit documentation, including illustrations, from a qualified testing and inspecting agency that is applicable to each through-penetration firestop configuration for construction and penetrating items.
  2. Where Project conditions require modification of qualified testing and inspecting agency's illustration to suit a particular through-penetration firestop condition, submit illustration approved by firestopping manufacturer's fire protection engineer with modifications marked.
- D. Product certificates signed by manufacturers of firestopping products certifying that their products comply with specified requirements.
- E. Product test reports from, and based on tests performed by, a qualified testing and inspecting agency evidencing compliance of firestopping with requirements based on comprehensive testing of current products.
- F. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, and other information specified.

#### 1.5 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide firestopping that complies with the following requirements and those specified under the "System Performance Requirements" article:
1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, Warnock Hersey, or another agency performing testing and follow-up inspection services for firestop systems that is acceptable to authorities having jurisdiction.
  2. Through-penetration firestop systems are identical to those tested per ASTM E 814 under conditions where positive furnace pressure differential of at least 0.01 inch of water (2.5 Pa) is maintained at a distance of 0.78 inch (20 mm) below the fill materials surrounding the penetrating items in the test assembly. Provide rated systems complying with the following requirements:
    - a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
    - b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by UL in their "Fire Resistance Directory," by Warnock Hersey, or by another qualified testing and inspecting agency.
  3. Fire-resistive joint sealant systems are identical to those tested for fire-response characteristics per ASTM E 119 under conditions where the positive furnace pressure differential is at least 0.01 inch of water (2.5 Pa), as measured 0.78 inch (20 mm) from the face exposed to furnace fire. Provide systems complying with the following requirements:
    - a. Fire-Resistance Ratings of Joint Sealants: As indicated by reference to design designations listed by UL in their "Fire Resistance Directory" or by another qualified testing and inspecting agency.
    - b. Joint sealants, including backing materials, bear classification marking of qualified testing and inspection agency.

- B. Information on drawings referring to specific design designations of through-penetration firestop systems is intended to establish requirements for performance based on conditions that are expected to exist during installation. Any changes in conditions and designated systems require the Architect's prior approval. Submit documentation showing that the performance of proposed substitutions equals or exceeds that of the systems they would replace and are acceptable to authorities having jurisdiction.
- C. Installer Qualifications: Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary experience, staff, and training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.
- D. Single-Source Responsibility: Obtain through-penetration firestop systems for each kind of penetration and construction condition indicated from a single manufacturer.
- E. Provide firestopping products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, Subpart F, Appendix A, Section 1, "Polarized Light Microscopy."
- F. Coordinating Work: Coordinate construction of openings and penetrating items to ensure that designated through-penetration firestop systems are installed per specified requirements.
- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver firestopping products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer; date of manufacture; lot number; shelf life, if applicable; qualified testing and inspecting agency's classification marking applicable to Project; curing time; and mixing instructions for multicomponent materials.
- B. Store and handle firestopping materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

#### 1.7 PROJECT CONDITIONS

- A. Environmental Conditions: Do not install firestopping when ambient or substrate temperatures are outside limits permitted by firestopping manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilation: Ventilate firestopping per firestopping manufacturers' instructions by natural means or, where this is inadequate, forced air circulation.

#### 1.8 SEQUENCING AND SCHEDULING

- A. Do not cover up those firestopping installations that will become concealed behind other construction until Owner's inspection agency and authorities having jurisdiction, if required, have examined each installation.

## PART 2 - PRODUCTS

### 2.1 FIRESTOPPING, GENERAL

- A. Compatibility: Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by firestopping manufacturer based on testing and field experience.
- B. Accessories: Provide components for each firestopping system that are needed to install fill materials and to comply with "System Performance Requirements" article in Part 1. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire-resistance-rated systems. Accessories include but are not limited to the following items:
  - 1. Permanent forming/damming/backing materials including the following:
    - a. Semirefractory fiber (mineral wool) insulation.
    - b. Ceramic fiber.
    - c. Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state.
    - d. Fire-rated formboard.
    - e. Joint fillers for joint sealants.
  - 2. Temporary forming materials.
  - 3. Substrate primers.
  - 4. Collars.
  - 5. Steel sleeves.
- C. Applications: Provide firestopping systems composed of materials specified in this Section that comply with system performance and other requirements.

### 2.2 FILL MATERIALS FOR THROUGH-PENETRATION FIRESTOP SYSTEMS

- A. Ceramic-Fiber and Mastic Coating: Ceramic fibers in bulk form formulated for use with mastic coating, and ceramic fiber manufacturer's mastic coating.
- B. Ceramic-Fiber Sealant: Single-component formulation of ceramic fibers and inorganic binders.
- C. Endothermic, Latex Compound Sealant: Single-component, endothermic, latex formulation.
- D. Intumescent, Latex Sealant: Single-component, intumescent, latex formulation.
- E. Intumescent Putty: Nonhardening, dielectric, water-resistant putty containing no solvents, inorganic fibers, or silicone compounds.
- F. Intumescent Wrap Strips: Single-component, elastomeric sheet with aluminum foil on one side.
- G. Job-Mixed Vinyl Compound: Prepackaged vinyl-based powder product for mixing with water at Project site to produce a paintable compound, passing ASTM E 136, with flame-spread and smoke-developed ratings of zero per ASTM E 84.

- H. Mortar: Prepackaged dry mix composed of a blend of inorganic binders, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogenous mortar.
- I. Pillows/Bags: Re-usable, heat-expanding pillows/bags composed of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents and fire-retardant additives.
- J. Silicone Foam: Two-component, silicone-based liquid elastomer that, when mixed, expands and cures in place to produce a flexible, nonshrinking foam.
- K. Silicone Sealant: Moisture-curing, single-component, silicone-based, neutral-curing elastomeric sealant of grade indicated below:
  - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping/ gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
  - 2. Grade for Horizontal Surfaces: Pourable (self-leveling) grade for openings in floors and other horizontal surfaces.
  - 3. Grade for Vertical Surfaces: Nonsag grade for openings in vertical and other surfaces.
- L. Solvent-Release-Curing Intumescent Sealant: Solvent-release-curing, single-component, synthetic-polymer-based sealant of grade indicated below:
  - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping/ gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.
  - 2. Grade for Horizontal Surfaces: Pourable (self-leveling) grade for openings in floors and other horizontal surfaces.
  - 3. Grade for Vertical Surfaces: Nonsag grade for openings in vertical and other surfaces.
- M. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
- N. Products: Subject to compliance with requirements, provide one of the following:
  - 1. Ceramic-Fiber and Mastic Coating:
    - a. FireMaster Bulk and FireMaster Mastic, Thermal Ceramics.
  - 2. Ceramic-Fiber Sealant:
    - a. Metacaulk 525, The RectorSeal Corporation.
  - 3. Endothermic, Latex Sealant:
    - a. Fyre-Shield, Tremco Inc.
  - 4. Endothermic, Latex Compounds:
    - a. Flame-Safe FS500/600 Series, International Protective Coatings Corp.
    - b. Flame-Safe FS900/FST900 Series, International Protective Coatings Corp.
  - 5. Intumescent Latex Sealant:

- a. Metacaulk 950, The RectorSeal Corporation.
  - b. Fire Barrier CP 25WB Caulk, 3M Fire Protection Products.
- 6. Intumescent Putty:
  - a. Pensil 500 Intumescent Putty, General Electric Co.
  - b. Flame-Safe FSP1000 Putty, International Protective Coatings Corp.
  - c. Fire Barrier Moldable Putty, 3M Fire Protection Products.
- 7. Intumescent Wrap Strips:
  - a. Dow Corning Fire Stop Intumescent Wrap Strip 2002, Dow Corning Corp.
  - b. CS2420 Intumescent Wrap, Hilti Construction Chemicals, Inc.
  - c. Fire Barrier FS-195 Wrap/Strip, 3M Fire Protection Products.
- 8. Job-Mixed Vinyl Compound:
  - a. USG Firecode Compound, United States Gypsum Co.
- 9. Mortar:
  - a. K-2 Firestop Mortar, Bio Fireshield, Inc.
  - b. Novasit K-10 Firestop Mortar, Bio Fireshield, Inc.
  - c. KBS-Mortar Seal, International Protective Coatings Corp.
- 10. Pillows/Bags:
  - a. Firestop Pillows, Bio Fireshield, Inc.
  - b. KBS Sealbags, International Protective Coatings Corp.
- 11. Silicone Foams:
  - a. Dow Corning Fire Stop Foam 2001, Dow Corning Corp.
  - b. Pensil 200 Foam, General Electric Co.
- 12. Silicone Sealants:
  - a. Dow Corning Firestop Sealant 2000, Dow Corning Corp.
  - b. Dow Corning Firestop Sealant SL 2003, Dow Corning Corp.
  - c. Pensil 100 Firestop Sealant, General Electric Co.
  - d. CS240 Firestop Sealant, Hilti Construction Chemicals, Inc.
  - e. Metacaulk 835, The RectorSeal Corporation.
  - f. Metacaulk 880, The RectorSeal Corporation.
  - g. Fyre-Sil, Tremco Inc.
  - h. Fyre-Sil S/L, Tremco Inc.
- 13. Solvent-Release-Curing Intumescent Sealants:
  - a. Biostop 500 Intumescent Firestop Caulk, Bio Fireshield, Inc.
  - b. Fire Barrier CP 25N/S Caulk, 3M Fire Protection Products.
  - c. Fire Barrier CP 25S/L Caulk, 3M Fire Protection Products.

## 2.3 FIRE-RESISTIVE ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that complies with ASTM C 920 requirements, including those referenced for Type, Grade, Class, and Uses, and requirements specified in this Section applicable to fire-resistive joint sealants.
- B. Sealant Colors: Provide color of exposed joint sealants to comply with the following:
  - 1. Provide custom colors to match Architect's samples.
  - 2. Match colors indicated by reference to manufacturer's standard designations.
  - 3. Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.
- C. Single-Component, Neutral-Curing Silicone Sealant: Type S; Grade NS; Class 25; exposure-related Use NT, and joint-substrate-related Uses M, G, A, and (as applicable to joint substrates indicated) O.
  - 1. Additional Movement Capability: Provide sealant with the capability to withstand the following percentage changes in joint width existing at time of installation, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, and remain in compliance with other requirements of ASTM C 920 for uses indicated:
    - a. 50 percent movement in both extension and compression for a total of 100 percent movement.
    - b. 100 percent movement in extension and 50 percent movement in compression for a total of 150 percent movement.
- D. Multicomponent, Nonsag, Urethane Sealant: Type M; Grade NS; Class 25; exposure-related Use NT, and joint-substrate-related Uses M, A, and (as applicable to joint substrates indicated) O.
  - 1. Additional Movement Capability: Provide sealant with the capability to withstand the following percentage change in joint width existing at time of installation, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, and remain in compliance with other requirements of ASTM C 920 for uses indicated:
    - a. 40 percent movement in extension and 25 percent in compression for a total of 65 percent movement.
    - b. 50 percent movement in both extension and compression for a total of 100 percent movement.
- E. Single-Component, Nonsag, Urethane Sealant: Type S; Grade NS; Class 25; and Uses NT, M, A, and (as applicable to joint substrates indicated) O.
- F. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
- G. Products: Subject to compliance with requirements, provide one of the following:
  - 1. Single-Component, Neutral-Curing, Silicone Sealant:
    - a. Dow Corning 790, Dow Corning Corp.
    - b. Dow Corning 795, Dow Corning Corp.
    - c. Silpruf, General Electric Co.
    - d. Ultraglaze, General Electric Co.
    - e. 864, Pecora Corp.



2. Multicomponent, Nonsag, Urethane Sealant:
  - a. Vulkem 922, Mameco International Inc.
  - b. Dynflex, Pecora Corp.
  - c. Dynatred, Pecora Corp.
  - d. Dynatrol II, Pecora Corp.
  - e. Sikaflex 2cn NS, Sika Corp.
  - f. Sonolastic NP 2, Sonneborn Building Products Div., ChemRex Inc.
  - g. Dymeric, Tremco Inc.
3. Single-Component, Nonsag, Urethane Sealant:
  - a. Isoflex 880 GB, Harry S. Peterson Co., Inc.
  - b. Isoflex 881, Harry S. Peterson Co., Inc.
  - c. Vulkem 921, Mameco International Inc.
  - d. Sikaflex--15LM, Sika Corp.

## 2.4 MIXING

- A. For those products requiring mixing prior to application, comply with firestopping manufacturer's directions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce firestopping 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 firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning: Clean out openings and joints immediately prior to installing firestopping to comply with recommendations of firestopping manufacturer and the following requirements:
  1. Remove all foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestopping.
  2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
  3. Remove laitance and form release agents from concrete.
- B. Priming: Prime substrates where recommended by firestopping 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 firestopping from contacting adjoining surfaces that will remain exposed upon completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing firestopping's seal with substrates.

### 3.3 INSTALLING THROUGH-PENETRATION FIRESTOPS

- A. General: Comply with the "System Performance Requirements" article in Part 1 and the through-penetration firestop manufacturer's installation instructions and drawings pertaining to products and applications indicated.
- B. Install forming/damming materials and other accessories of types required to support fill materials during their application and in the position needed to produce the cross-sectional shapes and depths required to achieve fire ratings of designated through-penetration firestop systems. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:
  - 1. Completely fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.
  - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
  - 3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

### 3.4 INSTALLING FIRE-RESISTIVE JOINT SEALANTS

- A. General: Comply with the "System Performance Requirements" article in Part 1, with ASTM C 1193, and with the sealant manufacturer's installation instructions and drawings pertaining to products and applications indicated.
- B. Install joint fillers to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability and develop fire-resistance rating required.
- C. Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint width that optimum sealant movement capability. Install sealants at the same time joint fillers are installed.
- D. Tool nonsag sealants immediately after sealant application and prior to the time skinning or curing begins. Form smooth, uniform beads of configuration indicated or required to produce fire-resistance rating, as well as to eliminate air pockets, and to ensure contact and adhesion of sealants with sides of joint. Remove excess sealant from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

### 3.5 FIELD QUALITY CONTROL

- A. Inspecting agency employed and paid by Owner will examine completed firestopping to determine, in general, if it is being installed in compliance with requirements.

- B. Inspecting agency will report observations promptly and in writing to Contractor and Architect.
- C. Do not proceed to enclose firestopping with other construction until reports of examinations are issued.
- D. Where deficiencies are found, repair or replace firestopping so that it complies with requirements.

### 3.6 CLEANING

- A. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.
- B. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to produce firestopping complying with specified requirements.

END OF SECTION 07270

SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes sealants for the following applications, including those specified by reference to this Section:
- B. This Section includes sealants for the following applications:
  - 1. Exterior joints in the following vertical surfaces and nontraffic horizontal surfaces:
    - a. Control and expansion joints in unit masonry.
    - b. Perimeter joints between materials listed above and frames of doors and windows.
    - c. Other joints as indicated.
    - d. Acoustical Sound deadening caulk.
- C. Related Sections include the following:
  - 1. Division 2 Section "Pavement Joint Sealants" for sealing joints in pavements, walkways, and curbing.
  - 2. Division 4 Section "Unit Masonry" for masonry control and expansion joint fillers and gaskets.

1.3 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.4 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for 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. Product Certificates: Signed by manufacturers of joint sealants certifying that products furnished comply with requirements and are suitable for the use indicated.
- D. Compatibility and Adhesion Test Reports: From sealant manufacturer indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

#### 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: 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.
  2. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 deg F (4.4 deg C).
  3. When joint substrates are wet.
- B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

#### 1.8 WARRANTY

- A. General Warranty: 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. Special Installer's Warranty: Written warranty, signed by Installer agreeing to repair or replace elastomeric joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PRODUCTS AND MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified in the sealant schedules at the end of Part 3.

### 2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range for this characteristic.

### 2.3 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealant Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant in the Elastomeric Joint-Sealant Schedule at the end of Part 3, including those referencing ASTM C 920 classifications for type, grade, class, and uses.
- B. Additional Movement Capability: Where additional movement capability is specified in the Elastomeric Joint-Sealant Schedule, provide products with the capability, when tested for adhesion and cohesion under maximum cyclic movement per ASTM C 719, to withstand the specified percentage change in the joint width existing at the time of installation and remain in compliance with other requirements of ASTM C 920 for uses indicated.
- C. Stain-Test-Response Characteristics: Where elastomeric sealants are specified in the Elastomeric Joint-Sealant Schedule to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.
- D. Continuous-Immersion-Test-Response Characteristics: Where elastomeric sealants will be immersed continuously in water, provide products that have undergone testing according to ASTM C 1247, including initial six-week immersion period and additional immersion periods specified below, and have not failed in adhesion or cohesion when tested with substrates indicated for Project.
  1. Three additional four-week immersion periods.
- E. Suitability for Contact with Food: Where elastomeric sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

### 2.4 LATEX JOINT SEALANTS

- A. Latex Sealant Standard: Comply with ASTM C 834 for each product of this description indicated in the Latex Joint-Sealant Schedule at the end of Part 3.

## 2.5 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
  - 1. Type C: Closed-cell material with a surface skin.
  - 2. Type O: Open-cell material.
  - 3. Type B: Bicellular material with a surface skin.
  - 4. Type: Any material indicated above.
- C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D 1056, nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 26 deg F (minus 32 deg C). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.
  - 1. Provide single or double backing to adequately close joint regardless of depth. Some locations may require multiple layers of "roap and caulk".
- D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

## 2.6 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 with joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

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

### 3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions and the following requirements:
  - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
  - 2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:
    - a. Concrete.
    - b. Masonry.
    - c. Unglazed surfaces of ceramic tile.
  - 3. Remove laitance and form-release agents from concrete.
  - 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
    - a. Metal.
    - b. Glass.
    - c. Porcelain enamel.
    - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### 3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.



1. Do not leave gaps between ends of sealant backings.
  2. Do not stretch, twist, puncture, or tear sealant backings.
  3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and back of joints.
- E. Install sealants by proven techniques to 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 provided for 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 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 sealants from surfaces adjacent to joint.
  2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
  3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
  4. Provide flush joint configuration, per Figure 5B in ASTM C 1193, where indicated.
  5. Provide recessed joint configuration, per Figure 5C in ASTM C 1193, of recess depth and at locations indicated.
- a. Use masking tape to protect adjacent surfaces of recessed tooled joints.

### 3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field-test joint-sealant adhesion to joint substrates as follows:
1. Extent of Testing: Test completed elastomeric sealant joints as follows:
    - a. Perform 10 tests for the first 1000 feet (300 m) of joint length for each type of elastomeric sealant and joint substrate.
  2. Test Method: Test joint sealants by hand-pull method described below:
    - a. Make knife cuts from one side of joint to the other, followed by two cuts approximately 2 inches (50 mm) long at sides of joint and meeting cross cut at one end. Place a mark 1 inch (25 mm) from cross-cut end of 2-inch (50-mm) piece.
    - b. Use fingers to grasp 2-inch (50-mm) piece of sealant between cross-cut end and 1-inch (25-mm) mark; pull firmly at a 90-degree angle or more in direction of side cuts while holding a ruler along side of sealant. Pull sealant out of joint to the distance recommended by sealant manufacturer for testing adhesive capability, but not less than that equaling specified maximum movement capability in extension; hold this position for 10 seconds.
    - c. For joints with dissimilar substrates, check adhesion to each substrate separately. Do this by extending cut along one side, checking adhesion to opposite side, and then repeating this procedure for opposite side.

3. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.
4. Inspect tested joints and report on the following:
  - a. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate. Compare these results to determine if adhesion passes sealant manufacturer's field- adhesion hand-pull test criteria.
  - b. Whether sealants filled joint cavities and are free from voids.
  - c. Whether sealant dimensions and configurations comply with specified requirements.
5. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.
6. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.

- B. Evaluation of Field-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements, will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

### 3.5 ACOUSTIC CAULK

- A. Provide and install Pro-Series® SC-175™ or equal: This acoustical caulk is to be used in practice rooms in and around cavity walls, ceiling and floor systems. The sealant is used on all exposed and unexposed perimeter joints, floor and ceiling runners, and cutouts in gypsum board, doors, frames and other areas where a sound rated assembly is required. The sealant is also applied or buttered around all electrical boxes and outlets, cold air returns, heating and air conditioning ducts, and other utility equipment penetrating wall surfaces for increased acoustical performances.

### 3.6 CLEANING

- A. Clean off excess sealants 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.

### 3.7 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

3.8 ELASTOMERIC JOINT-SEALANT SCHEDULE

- A. Single-Component Nonsag Urethane Sealant: Vertical Expansion Joints and elsewhere, where joint sealants of this type are indicated, provide products complying with the following:
  - 1. Products:
    - a. Sikaflex - 1a; Sika Corporation.
    - b. NP 1; Sonneborn Building Products Div., ChemRex Inc.
  - 2. Type and Grade: S (single component) and NS (nonsag).
- B. Coordinate with Outsulation Plus Drivit EIFS system for sealant acceptable to DRIVIT warranty.
  - 1. Tremco Inc.
    - a. Sealant: Spectrem 1, 3 & 4.
    - b. Primer: Tremprime Silicone Porous Primer.
  - 2. Sika Corporation
    - a. Sealant: Sikaflex 2C
    - b. Primer: Sikaflex 429

3.9 LATEX JOINT-SEALANT SCHEDULE

- A. Latex Sealant: Where joint sealants of this type are indicated, provide products complying with the following:
  - 1. Products:
    - a. AC-20; Pecora Corporation.
    - b. Sonolac; Sonneborn Building Products Div., ChemRex, Inc.
    - c. Tremflex 834; Tremco.

END OF SECTION 079200

## SECTION 081113 - STEEL DOORS AND FRAMES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes steel doors and frames.
  - 1. Exterior and Interior steel doors and frames
  - 2. Interior Steel Window Frames.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 4 Section "Unit Masonry" for building anchors into and grouting frames in masonry construction.
  - 2. Division 8 Section "Flush Wood Doors" for hollow-core and solid-core wood doors installed in steel frames.
  - 3. Division 8 Section "Door Hardware" for door hardware and weatherstripping.
  - 4. Division 8 Section "Glazing" for glass in steel doors and sidelights.
  - 5. Division 9 Section "Painting" for field painting primed doors and frames.

#### 1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for each type of door and frame specified, including details of construction, materials, dimensions, hardware preparation, core, label compliance, sound ratings, profiles, and finishes.
- C. Shop Drawings showing fabrication and installation of steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.
- D. Door Schedule: Submit schedule of doors and frames using same reference numbers for details and openings as those on Contract Drawings.
  - 1. Indicate coordination of glazing frames and stops with glass and glazing requirements.

#### 1.4 QUALITY ASSURANCE

- A. Provide doors and frames complying with ANSI/SDI 100 "Recommended Specifications for Standard Steel Doors and Frames" and as specified.

- B. Fire-Rated Door Assemblies: Units that comply with NFPA 80, are identical to door and frame assemblies tested for fire-test-response characteristics per ASTM E 152, and are labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.
- B. Inspect doors and frames on delivery for damage. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect; otherwise, remove and replace damaged items as directed.
- C. Store doors and frames at building site under cover. Place units on minimum 4-inch high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If cardboard wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch spaces between stacked doors to promote air circulation.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturer products that must be incorporated in the Work is the following:
  - 1. Steel Doors and Frames:
    - a. Steelcraft.

#### 2.2 MATERIALS

- A. Hot-Rolled Steel Sheets and Strip: Commercial-quality carbon steel, pickled and oiled, complying with ASTM A 569 (ASTM A 569M).
- B. Cold-Rolled Steel Sheets: Carbon steel complying with ASTM A 366 (ASTM A 366M), commercial quality, or ASTM A 620 (ASTM A 620M), drawing quality, special killed.
- C. Galvanized Steel Sheets: Zinc-coated carbon steel complying with ASTM A 526 (ASTM A 526M), commercial quality, or ASTM A 642 (ASTM A 642M), drawing quality, hot-dip galvanized according to ASTM A 525, with A 60 or G 60 (ASTM A 525M, with Z 180 or ZF 180) coating designation, mill phosphatized.
- D. Supports and Anchors: Fabricated from not less than 0.0478-inch thick steel sheet; 0.0516-inch thick galvanized steel where used with galvanized steel frames.
- E. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where items are to be built into exterior walls, hot-dip galvanize complying with ASTM A 153, Class C or D as applicable.

## 2.3 DOORS

- A. Steel Doors: Provide 1-3/4-inch thick doors of materials and ANSI/SDI 100 grades and models specified below, or as indicated on Drawings or schedules:
  - 1. Interior Doors: Grade II, heavy-duty, Model 1, full flush design, minimum 16 gauge cold-rolled steel sheet faces.
  - 2. Exterior Doors: Grade III, extra heavy-duty, Model 1, full flush design, minimum 16 gauge, A 60 galvanized steel.

## 2.4 FRAMES

- A. Provide metal frames for doors, transoms, sidelights, borrowed lights, and other openings, according to ANSI/SDI 100, and of types and styles as shown on Drawings and schedules. Conceal fastenings, unless otherwise indicated. Fabricate frames of minimum 0.0478-inch thick cold-rolled steel sheet.
  - 1. Fabricate frames with mitered or coped and continuously welded corners.
  - 2. Form exterior frames from 14 gauge galvanized steel.
- B. Door Silencers: Except on weatherstripped frames, drill stops to receive 3 silencers on strike jambs of single-door frames and 2 silencers on heads of double-door frames.
- C. Plaster Guards: Provide minimum 0.0179-inch thick steel plaster guards or mortar boxes at back of hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.
- D. Grout: When required in masonry construction, as specified in Division 4 Section "Unit Masonry."

## 2.5 FABRICATION

- A. Fabricate steel door and frame units to be rigid, neat in appearance, and free from defects, warp, or buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site. Comply with ANSI/SDI 100 requirements.
  - 1. Internal Construction: One of the following manufacturer's standard core materials according to SDI standards:
    - a. Resin-impregnated paper honeycomb – at interior doors.
    - b. Rigid polyurethane conforming to ASTM C 591 – at exterior doors.
  - 2. Clearances: Not more than 1/8 inch at jambs and heads, except not more than 1/4 inch between non-fire-rated pairs of doors. Not more than 3/4 inch at bottom.
    - a. Fire Doors: Provide clearances according to NFPA 80.
- B. Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from only cold-rolled steel sheet.
- C. Tolerances: Comply with SDI 117 "Manufacturing Tolerances Standard Steel Doors and Frames."

- D. Fabricate concealed vertical stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.
- E. Galvanized Steel Doors, Panels, and Frames: For the following locations, fabricate doors, panels, and frames from A 60 galvanized steel sheet according to SDI 112. Close top and bottom edges of doors flush as an integral part of door construction or by addition of minimum 0.0635-inch thick galvanized steel channels, with channel webs placed even with top and bottom edges. Seal joints in top edges of doors against water penetration. Doors shall be vertically stiffened internally.
  - 1. At exterior locations.
- F. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.
- G. Thermal-Rated (Insulating) Assemblies: At exterior locations and elsewhere as shown or scheduled, provide doors fabricated as thermal-insulating door and frame assemblies and tested according to ASTM C 236 or ASTM C 976 on fully operable door assemblies.
  - 1. Unless otherwise indicated, provide thermal-rated assemblies with U-value rating of 0.09 Btu/sq. ft. x h x deg For better.
- H. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements of SDI 107 and ANSI A115 Series specifications for door and frame preparation for hardware.
  - 1. For concealed overhead door closers, provide space, cutouts, reinforcing, and provisions for fastening in top rail of doors or head of frames, as applicable.
- I. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.
- J. Locate hardware as indicated on Shop Drawings or, if not indicated, according to the Door and Hardware Institute's (DHI) "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
- K. Glazing Stops: Minimum 0.0359-inch thick steel or 0.040-inch thick aluminum.
  - 1. Provide screw-applied, removable, glazing beads on inside of glass,, and other panels in doors.

## 2.6 FINISHES, GENERAL

- A. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for steel sheet finishes.
- B. Apply primers and organic finishes to doors and frames after fabrication.

## 2.7 GALVANIZED STEEL SHEET FINISHES

- A. Surface Preparation: Clean surfaces with nonpetroleum solvent so that surfaces are free of oil or other contaminants. After cleaning, apply a conversion coating of the type suited to the organic coating applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

1. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035 or SSPC-Paint 20.
- B. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply air-dried primer specified below immediately after cleaning and pretreatment.
  1. Shop Primer: Zinc-dust, zinc-oxide primer paint complying with performance requirements of FS TT-P-641, Type II. Apply shop primer that is **compatible with finish paint systems indicated**, and has capability to provide a sound foundation for field-applied topcoats.

## 2.8 STEEL SHEET FINISHES

- A. Surface Preparation: Solvent-clean surfaces to comply with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel to comply with SSPC-SP 5 (White Metal Blast Cleaning) or SSPC-SP 8 (Pickling).
- B. Factory Priming for Field-Painted Finish: Apply shop primer that complies with ANSI A224.1 acceptance criteria, is **compatible with finish paint systems indicated**, and has capability to provide a sound foundation for field-applied topcoats. Apply primer immediately after surface preparation and pretreatment.
- C. Site: Field Painting Spray finished prior to hardware installation.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.
- B. Placing Frames: Comply with provisions of SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
  1. Except for frames located in existing concrete, masonry, or gypsum board assembly construction, place frames before constructing enclosing walls and ceilings.
  2. In masonry construction, install at least 3 wall anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.
  3. At existing concrete or masonry construction, install at least 3 completed opening anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Set frames and secure to adjacent construction with bolts and masonry anchorage devices.
  4. In metal-stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. In steel-stud partitions, attach wall anchors to studs with screws.
  5. In in-place gypsum board partitions, install knock-down, slip-on, drywall frames.
  6. Install fire-rated frames according to NFPA 80.



- C. Door Installation: Fit hollow-metal doors accurately in frames, within clearances specified in ANSI/SDI 100.
  - 1. Fire-Rated Doors: Install with clearances specified in NFPA 80.
  - 2. Smoke-Control Doors: Comply with NFPA 105.

### 3.2 ADJUSTING AND CLEANING

- A. Prime Coat Touchup: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.
- B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION 08110

## SECTION 081416 - FLUSH WOOD DOORS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Solid-core doors with plastic laminate as scheduled on the drawings.
  - 2. Factory fitting flush wood doors to frames and factory machining for hardware.
- B. Related Sections include the following:
  - 1. Division 8 Section "Glazing" for glass view panels in flush wood doors.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of door. Include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
  - 1. Indicate dimensions and locations of mortises and holes for hardware.
  - 2. Indicate dimensions and locations of cutouts.
  - 3. Indicate requirements for veneer matching.
  - 4. Indicate doors to be factory finished and finish requirements.
  - 5. Indicate fire ratings for fire doors.
- C. Samples for Initial Selection: Color charts consisting of actual materials in small sections for the following:
  - 1. Plastic-Laminate Door Faces: Show the full range of colors, textures, and patterns available.
- D. Samples for Verification:
  - 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches (200 by 250 mm), for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.
  - 2. Corner sections of doors, approximately 8 by 10 inches (200 by 250 mm), 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.
  - 3. Plastic laminate, 6 inches (150 mm) square, for each color, texture, and pattern selected.

4. Corner sections of plastic-laminate-clad doors, approximately 8 by 10 inches (200 by 250 mm).
5. Frames for light openings, 6 inches (150 mm) long, for each material, type, and finish required.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.
- B. Quality Standard: Comply with AWI's "Architectural Woodwork Quality Standards Illustrated."
  1. Provide AWI Quality Certification Labels or an AWI letter of licensing for Project indicating that doors comply with requirements of grades specified.
- C. Forest Certification: Provide doors made from wood products obtained from forests certified by an FSC-accredited certification body to comply with FSC 1.2, "Principles and Criteria."
- D. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

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

#### 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

#### 1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist) more than 1/4 inch (6.4 mm) in a 42-by-84-inch (1067-by-2134-mm) section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 75-mm) span.
  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. Solid-Core Interior Doors: Life of installation.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Flush Wood Doors:
    - a. Algoma Hardwoods Inc.
    - b. Buell Door Company.
    - c. GRAHAM Manufacturing Corp.
    - d. Haley Brothers, Inc.
    - e. IPIK Door Company.
    - f. VT Industries Inc.
    - g. Weyerhaeuser Company.

### 2.2 DOOR CONSTRUCTION, GENERAL

- A. Adhesives: Do not use adhesives containing urea formaldehyde.
- B. Plastic-Laminate-Faced Doors:
  - 1. Grade: Custom.
  - 2. Laminate Faces: High-pressure decorative laminates complying with NEMA LD 3, Grade HGS.
  - 3. Colors, Patterns, and Finishes: As selected by Architect from laminate manufacturer's full range of products.
  - 4. Stiles: Plastic-laminate matching faces, applied before faces.

### 2.3 SOLID-CORE DOORS

- A. Particleboard Cores: Comply with the following requirements:
  - 1. Particleboard: ANSI A208.1, Grade LD-1.
    - a. Use particleboard made with binder containing no urea-formaldehyde resin.
  - 2. Blocking: Provide wood blocking in particleboard-core doors as follows:
    - a. 5-inch (125-mm) top-rail blocking, in doors indicated to have closers.
    - b. 5-inch (125-mm) bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
    - c. 5-inch (125-mm) midrail blocking, in doors indicated to have exit devices.
- B. Interior Plastic-Laminate-Faced Doors:
  - 1. Core: Particleboard.
  - 2. Construction: Three plies with stiles and rails bonded to core, then entire unit abrasive planed before faces are applied.
- C. Fire-Rated Doors:

1. Construction: Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as needed to provide fire rating indicated.
2. Blocking: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated as follows:
  - a. 5-inch (125-mm) top-rail blocking.
  - b. 5-inch (125-mm) bottom-rail blocking, in doors indicated to have protection plates.
  - c. 5-inch (125-mm) midrail blocking, in doors indicated to have armor plates.
  - d. 5-inch (125-mm) midrail blocking in doors indicated to have exit devices.
3. Edge Construction: At hinge stiles, provide manufacturer's standard laminated-edge construction with improved screw-holding capability and split resistance and with outer stile matching face veneer.
4. Pairs: Provide fire-rated pairs with fire-retardant stiles matching face veneer that are labeled and listed for kinds of applications indicated without formed-steel edges and astragals.

## 2.4 LIGHT FRAMES

- A. Metal Frames for Light Openings in Fire Doors: Manufacturer's standard frame formed of 0.0478-inch- (1.2-mm-) thick, cold-rolled steel sheet; factory primed and approved for use in doors of fire rating indicated. Frames shall be thru-bolted and shall be equal to Anemostat #FGS-75.

## 2.5 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:
  1. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements in NFPA 80 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, DHI A115-W series standards, and hardware templates.
  1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
  2. Metal Astragals: Premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.
  1. Light Openings: Trim openings with moldings of material and profile indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.

1. Verify that 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 Division 8 Section "Door Hardware."
- B. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.
1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

### 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 081416



## SECTION 087100 - DOOR HARDWARE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes:
  - 1. Mechanical door hardware for the following:
    - a. Swinging doors.
  - 2. Cylinders for door hardware.
  - 3. Verify hardware is compatible with MSU existing system in the Fain Fine Arts Building.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Other Action Submittals:
  - 1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
    - a. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
    - b. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
    - c. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
    - d. Content: Include the following information:
      - 1) Identification number, location, hand, fire rating, size, and material of each door and frame.
      - 2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
      - 3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.



- 4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.
  - 5) Fastenings and other pertinent information.
  - 6) Explanation of abbreviations, symbols, and codes contained in schedule.
  - 7) Mounting locations for door hardware.
  - 8) List of related door devices specified in other Sections for each door and frame.
2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and Architectural Hardware Consultant.
- B. Product Certificates: For electrified door hardware, from the manufacturer.
  1. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
- C. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.
- D. Warranty: Special warranty specified in this Section.

#### 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
  1. Warehousing Facilities: In Project's vicinity.
  2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
  3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as follows:
  1. For door hardware, an Architectural Hardware Consultant (AHC).

- C. Source Limitations: Obtain each type of door hardware from a single manufacturer as much as possible.
  - 1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
- D. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies 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, unless otherwise indicated.
- E. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
  - 1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. at the tested pressure differential of 0.3-inch wg of water.
- F. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- G. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.
- H. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and Texas Accessibility Guidelines.
  - 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
  - 2. Comply with the following maximum opening-force requirements:
    - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
    - b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
  - 3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
  - 4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.
- I. Keying Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." In addition to Owner, Construction Manager, Contractor, and Architect, conference participants shall also include supplier's Architectural Hardware Consultant and Owner's security consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
  - 1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
  - 2. Preliminary key system schematic diagram.
  - 3. Requirements for key control system.
  - 4. Requirements for access control.

5. Address for delivery of keys.

J. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Inspect and discuss preparatory work performed by other trades.
3. Inspect and discuss electrical roughing-in for electrified door hardware.
4. Review sequence of operation for each type of electrified door hardware.
5. Review required testing, inspecting, and certifying procedures.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.
- D. Deliver keys and permanent cores to Owner by registered mail overnight package service, or in person.

1.8 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
- E. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
  1. Failures include, but are not limited to, the following:

- a. Structural failures including excessive deflection, cracking, or breakage.
  - b. Faulty operation of doors and door hardware, caused by product defects.
  - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
2. Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
  - a. Exit Devices: Three years from date of Substantial Completion.
  - b. Manual Closers: 10 years from date of Substantial Completion.

#### 1.10 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Provide parts and supplies that are the same as those used in the manufacture and installation of original products.

### PART 2 - PRODUCTS

#### 2.1 SCHEDULED DOOR HARDWARE

- A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" to comply with requirements in this Section.
  1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products only.
  2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:
  1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required no substitutions. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.

#### 2.2 HINGES

- A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.
  1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. IVES Hardware; an Ingersoll-Rand company.

## 2.3 CENTER-HUNG AND OFFSET PIVOTS

- A. Center-Hung and Offset Pivots: BHMA A156.4.

1. Manufacturers: Subject to compliance with requirements, **provide products by the following**

- a. IVES Hardware; an Ingersoll-Rand company.

## 2.4 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: As indicated in door hardware schedule.

- B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Mortise Locks: Minimum 3/4-inch latchbolt throw.
2. Deadbolts: Minimum 1-inch bolt throw.

- C. Lock Backset: 2-3/4 inches, unless otherwise indicated.

- D. Lock Trim:

1. Description: As indicated on Drawings.
2. Levers: Wrought.
3. Escutcheons (Roses): Wrought.
4. Dummy Trim: Match lock trim and escutcheons.
5. Operating Device: Lever with escutcheons (roses).

- E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

- F. Mortise Locks: BHMA A156.13; Operational Grade 1; stamped steel case with steel or brass parts; Series 1000.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.

- G. Push-Pull Latches: Bored, BHMA A156.2; Series 4000 Mortise, BHMA A156.13; Grade 1; with paddle handles that retract latchbolt; capable of being mounted vertically or horizontally.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.
- b. IVES Hardware; an Ingersoll-Rand company.

## 2.5 MANUAL FLUSH BOLTS

- A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. IVES Hardware; an Ingersoll-Rand company.

## 2.6 EXIT DEVICES AND AUXILIARY ITEMS

- A. Exit Devices and Auxiliary Items: BHMA A156.3.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. Von Duprin; an Ingersoll-Rand company.

## 2.7 LOCK CYLINDERS

- A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.
  - 1. Manufacturer: Same manufacturer as for locking devices.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the:
    - a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company. Verify this is compatible with MSU existing system.
- B. Standard Lock Cylinders: BHMA A156.5; Grade 1; permanent cores that are interchangeable; face finished to match lockset.
- C. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

## 2.8 KEYING

- A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.
  - 1. Great-Grand Master Key System: Change keys, a master key, a grand master key, and a great-grand master key operate cylinders.
  - 2. Existing System:
    - a. Master key or grand master key locks to Owner's existing system.
- B. Keys: Nickel silver.
  - 1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
    - a. Notation: "DO NOT DUPLICATE.

2. Quantity: In addition to one extra key blank for each lock, provide the following:

- a. Cylinder Change Keys: Three.
- b. Master Keys: Five.
- c. Grand Master Keys: Five.
- d. Great-Grand Master Keys: Five.

## 2.9 SURFACE CLOSERS

- A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. LCN Closers; an Ingersoll-Rand company.

## 2.10 MECHANICAL STOPS AND HOLDERS

- A. Wall- and Floor-Mounted Stops: BHMA A156.16; Stainless Steel base metal.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. IVES Hardware; an Ingersoll-Rand company.

## 2.11 OVERHEAD STOPS AND HOLDERS

- A. Overhead Stops and Holders: BHMA A156.8.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Glynn-Johnson; an Ingersoll-Rand company.

## 2.12 DOOR GASKETING

- A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. National Guard Products.

2.13 THRESHOLDS

- A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. National Guard Products.

2.14 METAL PROTECTIVE TRIM UNITS

- A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch- thick, finish as indicated; with manufacturer's standard machine or self-tapping screw fasteners.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. IVES Hardware; an Ingersoll-Rand company.

2.15 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.
  - 1. Manufacturer's identification is permitted on rim of lock cylinders only.
- B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.
- C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
  - 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
  - 2. Fire-Rated Applications:
    - a. Wood or Machine Screws: For the following:
      - 1) Hinges mortised to doors or frames; use threaded-to-the-head wood screws for wood doors and frames.
      - 2) Strike plates to frames.
      - 3) Closers to doors and frames.
    - b. Steel Through Bolts: For the following unless door blocking is provided:



- 1) Surface hinges to doors.
  - 2) Closers to doors and frames.
  - 3) Surface-mounted exit devices.
3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
  4. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
  5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

## 2.16 FINISHES

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
- B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

### 3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights unless otherwise indicated or required to comply with governing regulations.
  1. Standard Steel Doors and Frames: ANSI/SDI A250.8.

2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
  - B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing. Do not install surface-mounted items until finishes have been completed on substrates involved.
    1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
    2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
  - C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
  - D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches of door height greater than 90 inches.
  - E. Lock Cylinders: Install construction cores to secure building and areas during construction period.
    1. Furnish permanent cores to Owner for installation.
  - F. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
  - G. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."
  - H. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.
  - I. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
  - J. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
  - K. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.
- 3.4 FIELD QUALITY CONTROL
- A. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
    1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

### 3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
  2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
  3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

### 3.6 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

### 3.7

#### DOOR HARDWARE SCHEDULE

#### LEGEND

IV = IVES  
VO = VON DUPRIN  
RO = ROCKWOOD  
LC = LCN  
KA = KABA ILCO ACCESS

NA = NATIONAL GUARD  
CR = CORBIN RUSSWIN  
GJ = GLYNN JOHNSON

#### HW - 1

#### DOOR #11:

6-0 X 7-0 PLAM DRS – HM FRAME PAIR (VERIFY SIZE)

8 EA – 5BB1HW 4.5 X 4.5 652 HINGES	IV
1EA – 9827 L – 996L-03-US32D-AM 425 LESS BOTTOM ROD RHR EXIT	VO
1 EA – 9827 EO-32D-AM-425 LESS BOTTOM ROD LHR EXIT	VO
1 EA – 3080-6-626 CT6 CYLINDER	CR
1 EA – 8000 -626 CORE – FACTORY KEYED	CR
2 EA – 4011 – AL CLOSERS	LC
2 EA – 904 X US32D OVERHEAD STOP	GJ
2 EA – 8400 B4E 8 X 34 US32D KICK PLATES	RO

HW – 2

DOOR # 6

4-0 X 7-0 PLAM DR – HM FRAMES

4 EA – 5BB1HW 4.5 X 4.5 652 HINGES

1 EA – SIMPLEX L1021 LEVER

1 EA – INTER-CHANGABLE COMPATIBLE WITH MSU SYSTEM CORES

1 EA – 406 CVX US32D WALL BUMPERS

IV  
KA  
CR  
RO

HW – 3  
SOUND CONTROLLED

DOOR # 1, 2, 3, 4, 5, 7

3-0 X 7-0 PLAM DRS – HM FRAMES

1 EA – CONTINUOUS HINGE

1 EA – CLOSER - PA4110-SNB-180°

1 EA – DOOR BOTTOM - 4301 CRL

1 EA – PERIMETER GASKET - 379CR

1 EA – ML2051 LWM 630C SA114XBRSTK CT6 LOCKSET

1 EA – 8000-626 CORES FACTORY KEYED

1 EA – 406 CVX U532D – WALL BUMPER

Z  
LCN  
P  
P  
CR  
CR  
RO

HW – 4

DOOR # 8, 9

3-0 X 7-0 PLAM DRS – HM FRAMES

3 EA – 5BB1HW 4.5 X 4.5 652 HINGES

1 EA – ML2051 LWM 630C SA114XBRSTK CT6 LOCKSET

1 EA – 8000-626 CORES FACTORY KEYED

1 EA – 406 CVX U532D – WALL BUMPER

IV  
CR  
CR  
RO

END OF SECTION 087100



SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:

- 1. Doors.

1.3 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Samples: For the following products, in the form of 12-inch square Samples for glass.
  - 1. Each color of tinted float glass.
  - 2. Insulating Glass
  - 3. Abrasion-Resistant Polycarbonate Glazing
  - 4. Fire Rated Glass

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Source Limitations for Clear Glass: Obtain clear float glass from one primary-glass manufacturer.
- C. Source Limitations for Coated Glass: Obtain coated glass from one manufacturer for each type of coating and each type and class of float glass indicated.
- D. Source Limitations for Insulating Glass: Obtain insulating-glass units from one manufacturer using the same type of glass and other components for each type of unit indicated.
- E. Source Limitations for Glazing Accessories: Obtain glazing accessories from one source for each product and installation method indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

## 1.6 PROJECT 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 liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40 deg .

## PART 2 - PRODUCTS

### 2.1 PRODUCTS AND MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products indicated in schedules at the end of Part 3.

### 2.2 TYPE GL1 FROM SHW - TEMPERED

- A. Fabrication Process: By vertical (tong-held) or horizontal (roller-hearth) process, at manufacturer's option, except provide horizontal process where indicated as tongless or free of tong marks.
  - 1. ¼" thick clear.

### 2.3 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. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer 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.

## 2.4 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

- A. Fabricate glass and other glazing products in sizes required to glaze 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 standard, to comply with system performance requirements.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with indoor and outdoor faces.
- C. Grind smooth and polish exposed glass edges.

## 2.5 GLAZING GASKETS

- A. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:
  - 1. Neoprene.
  - 2. EPDM.
  - 2. Silicone.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine framing glazing, 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 system.
  - 3. Minimum required face or 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.

### 3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glazing, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.



- 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 sealant-substrate 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 the length plus width is larger than 50 inches as follows:
  - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
  - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

#### 3.4 GASKET GLAZING (DRY)

- A. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Install gaskets so they protrude past face of glazing stops.

3.5 PROTECTION AND CLEANING

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
- B. Protect glazing from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glazing, remove them immediately as recommended by glazing manufacturer.
- C. Examine glazing surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glazing manufacturer.
- D. Remove and replace glazing that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.
- E. Wash glazing 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 glazing as recommended by glazing manufacturer.

END OF SECTION 088000



## SECTION 092550 - GYPSUM BOARD ASSEMBLIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Bearing and Nonload-bearing steel framing members for gypsum board assemblies.
  - 2. Gypsum board assemblies attached to steel framing.
  - 3. Vandal Resistant Gypsum Board assemblies
  - 4. Sound Attenuation Wall Assembly.

#### 1.3 DEFINITIONS

- A. Gypsum Board Construction Terminology: Refer to ASTM C 11 and GA-505 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

#### 1.4 ASSEMBLY PERFORMANCE REQUIREMENTS

- A. Sound Transmission Characteristics: For gypsum board assemblies with STC ratings, provide materials and construction identical to those of assemblies whose STC ratings were determined according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.
- B. Fire Resistance: Provide gypsum board assemblies with fire-resistance ratings indicated.

#### 1.5 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for each type of product specified.
- C. Shop Drawings showing locations, fabrication, and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other units of Work.
- D. Product certificates signed by manufacturers of gypsum board assembly components certifying that their products comply with specified requirements.

#### 1.6 QUALITY ASSURANCE

- A. Single-Source Responsibility for Steel Framing: Obtain steel framing members for gypsum board assemblies from a single manufacturer, unless otherwise indicated.

- B. Single-Source Responsibility for Panel Products: Obtain each type of gypsum board and other panel products from a single manufacturer.
- C. Single-Source Responsibility for Finishing Materials: Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.
- D. Fire-Test-Response Characteristics: Where fire-resistance-rated gypsum board assemblies are indicated, provide gypsum board assemblies that comply with the following requirements:
  - 1. Fire-Resistance Ratings: As indicated by GA File Numbers in GA-600 "Fire Resistance Design Manual" or design designations in UL "Fire Resistance Directory" or in the listing of another testing and inspecting agency acceptable to authorities having jurisdiction.
  - 2. Gypsum board assemblies indicated are identical to assemblies tested for fire resistance according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
  - 3. Deflection and Firestop Track: Top runner provided in fire-resistance-rated assemblies indicated is labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Neatly stack gypsum panels flat to prevent sagging.

#### 1.8 PROJECT CONDITIONS

- A. Environmental Conditions, General: Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C 840 requirements or gypsum board manufacturer's recommendations, whichever are more stringent.
- B. Room Temperatures: For nonadhesive attachment of gypsum board to framing, maintain not less than 40 deg F (4 deg C). For adhesive attachment and finishing of gypsum board, maintain not less than 50 deg F (10 deg C) for 48 hours before application and continuously after until dry. Do not exceed 95 deg F (35 deg C) when using temporary heat sources.
- C. Ventilation: Ventilate building spaces as required to dry joint treatment materials. Avoid drafts during hot, dry weather to prevent finishing materials from drying too rapidly.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:  
NOTE: Dimpled Studs are not acceptable.
  - 1. Steel Framing and Furring:
    - a. Clark Steel Framing, Inc.
    - b. Dietrich Industries, Inc.

- c. National Gypsum Co.; Gold Bond Building Products Division.
  - 2. Grid Suspension Assemblies:
    - a. Armstrong World Industries, Inc.
    - b. Chicago Metallic Corp.
    - c. USG Interiors, Inc.
  - 3. Gypsum Board and Related Products:
    - a. Domtar Gypsum.
    - b. Georgia-Pacific Corp.
    - c. National Gypsum Co.; Gold Bond Building Products Division.
    - d. United States Gypsum Co.
- B. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work where proprietary gypsum wallboard is indicated include, but are not limited to, the following:
- 1. Fire-Shield G; National Gypsum Co.; Gold Bond Building Products Division.
  - 2. SHEETROCK Brand Gypsum Panels, FIRECODE Core; United States Gypsum Co.
  - 3. HI-IMPACT Brand XP Gypsum Wallboard, National Gypsum Co.; Gold Bond Building Products Division.

## 2.2 STEEL FRAMING FOR WALLS AND PARTITIONS

- A. General: Provide steel framing members complying with the following requirements:
- 1. Protective Coating: ASTM A 653, G 40 (ASTM A 653M, Z 90) hot-dip galvanized coating.
- B. Steel Studs and Runners: ASTM C 645, with flange edges of studs bent back 90 degrees and doubled over to form 3/16-inch-wide minimum lip (return), and complying with the following requirements for minimum thickness of base (uncoated) metal and for depth:
- 1. Thickness: 0.0179 inch, unless otherwise indicated. At stud heights exceeding 13', provide stud thickness of 0.0312 inch.
    - a.) Stud thickness or spacing shall not be less than recommended by the manufacturer – for typical applications of heights required.
  - 2. Depth: As indicated.
- C. Fasteners for Metal Framing: Provide fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing and furring members securely to substrates involved; complying with the recommendations of gypsum board manufacturers for applications indicated.

## 2.3 STEEL SUSPENDED CEILING AND SOFFIT FRAMING

- A. Components, General: Comply with ASTM C 754 for conditions indicated.
- B. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch- diameter wire, or double strand of 0.0475-inch diameter wire.
- C. Hanger Attachments to Concrete: As follows:

1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching hanger wires and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by a qualified independent testing agency.
  - a. Type: Postinstalled, expansion anchor
- D. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by a qualified independent testing agency.
- E. Hangers: As follows:
  2. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.
  2. Rod Hangers: ASTM A 510, mild carbon steel.
    - a. Diameter: 1/4-inch
    - b. Protective Coating: ASTM A 153/A 153M, hot-dip galvanized
  3. Flat Hangers: Commercial-steel sheet, ASTM A 653/A 653M, G40, hot-dip galvanized
    - a. Size: 1 by 3/16 inch by length indicated
  4. Angle Hangers: ASTM A 653/A 653M, G60 hot-dip galvanized commercial-steel sheet.
    - a. Minimum Base Metal Thickness: 0.0312 inch.
    - b. Size: 1-5/8 by 1-5/8 inches
- F. Carrying Channels: Cold-rolled, commercial-steel sheet with a base metal thickness of 0.0538 inch, a minimum 1/2-inch wide flange, with ASTM A 653/A 653M, G40, hot-dip galvanized zinc coating.
  4. Depth: 1-1/2 inches
- G. Furring Channels (Furring Members): Commercial-steel sheet with ASTM A 653/A 653M, G40, hot-dip galvanized zinc coating.
  1. Cold Rolled Z Channels: 0.0538-inch bare steel thickness, with minimum 1/2-inch wide flange, 3/4 inch deep.
  2. Steel Studs: ASTM C 645.
    - a. Minimum Base Metal Thickness: 0.0312 inch
    - b. Depth: 1-5/8 inches
  3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
    - a. Minimum Base Metal Thickness: 0.0312 inch

## 2.4 GYPSUM BOARD PRODUCTS

- A. General: Provide gypsum board of types indicated in maximum lengths available that will minimize end-to-end butt joints in each area indicated to receive gypsum board application.
  1. Widths: Provide gypsum board in widths of 48 inches (1219 mm).
- B. Gypsum Wallboard: ASTM C 36 and as follows:
  1. Type: Type X (fire-resistant).
  2. Edges: Tapered.
  3. Thickness: 5/8 inch unless otherwise indicated on the drawings.

C. Hi-Impact Gypsum Wallboard:

1. Type: Type X (vandal-resistant).
2. Edges: Tapered.
3. Thickness: 5/8 inch unless otherwise indicated on the drawings.
4. Location: At all areas except those with ceramic wall tile finish – ref. Finish Schedule for locations of ceramic tile.

2.5 TRIM ACCESSORIES

A. Accessories for Interior Installation: Cornerbead, edge trim, and control joints complying with ASTM C 1047 and requirements indicated below:

1. Material: Formed metal or plastic, with metal complying with the following requirement:
  - a. Steel sheet zinc coated by hot-dip process or rolled zinc.
2. Shapes indicated below by reference to Fig. 1 designations in ASTM C 1047:
  - a. Cornerbead on outside corners, unless otherwise indicated.
  - b. LC-bead with both face and back flanges; face flange formed to receive joint compound. Use LC-beads for edge trim, unless otherwise indicated.
  - c. L-bead with face flange only; face flange formed to receive joint compound
  - d. U-bead with face and back flanges; face flange formed to be left without application of joint compound. Use U-bead where indicated.
  - a. One-piece control joint formed with "V" slot and removable strip covering slot opening.
  - b. U-Bead: J-shaped; exposed short flange does not receive joint compound;
  - c. Expansion (Control) Joint: Use where indicated.

B. Accessory for Curved Edges: Cornerbead formed of metal, plastic, or metal combined with plastic, with either notched or flexible flanges that are bendable to curvature radius.

C. Accessories for Exterior Installations: Cornerbead, edge trim, and control joints formed from steel sheet zinc coated by hot-dip process or rolled zinc complying with ASTM C 1047, in shapes indicated below by reference to Fig. 1 designations in ASTM C 1047.

1. Cornerbead on outside corners, unless otherwise indicated.
2. Edge trim complying with shape LC-bead per Fig. 1, unless otherwise indicated.
3. One-piece control joint formed from rolled zinc with V-shaped slot and removable strip covering slot opening.

2.6 JOINT TREATMENT MATERIALS

A. General: Provide joint treatment materials complying with ASTM C 475 and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.

B. Joint Tape for Gypsum Board: Paper reinforcing tape, unless otherwise indicated.

C. Setting-Type Joint Compounds for Gypsum Board: Factory-packaged, job-mixed, chemical-hardening powder products formulated for uses indicated.



1. Where setting-type joint compounds are indicated as a taping compound only or for taping and filling only, use formulation that is compatible with other joint compounds applied over it.
2. For prefilling gypsum board joints, use formulation recommended by gypsum board manufacturer.
3. For filling joints and treating fasteners of water-resistant gypsum backing board behind base for ceramic tile, use formulation recommended by gypsum board manufacturer.
4. For topping compound, use sandable formulation.

## 2.7 MISCELLANEOUS MATERIALS

- A. General: Provide auxiliary materials for gypsum board construction that comply with referenced standards and recommendations of gypsum board manufacturer.
- B. Laminating Adhesive: Special adhesive or joint compound recommended for laminating gypsum panels.
- C. Spot Grout: ASTM C 475, setting-type joint compound recommended for spot-grouting hollow metal door frames.
- D. Steel drill screws complying with ASTM C 954 for fastening gypsum board to steel members from 0.033 to 0.112 inch (0.84 to 2.84 mm) thick
- E. Steel drill screws of size and type recommended by unit manufacturer for fastening cementitious backer units.
- F. Gypsum Board Nails: ASTM C 514.
- G. Sound-Attenuation Blankets: Unfaced mineral-fiber blanket insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665 for Type I (blankets without membrane facing).
  1. Mineral-Fiber Type: Fibers manufactured from glass.
  2. Thickness Doubled in and around Music Room.
- H. Thermal Insulation: Material indicated below, of thickness and width to fill voids formed by Z-furring members:
  1. Unfaced Mineral-Fiber Blanket Insulation: Unfaced mineral-fiber blanket insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665 for Type I (blankets without membrane facing).
    - a. Mineral-Fiber Type: Fibers manufactured from glass.

## 2.8 TEXTURE FINISH PRODUCTS

- A. Primer: Of type recommended by texture finish manufacturer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates to which gypsum board assemblies attach or abut, installed hollow metal frames, cast-in-anchors, and structural framing, with Installer present, for compliance with

requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.2 INSTALLING STEEL FRAMING, GENERAL

- A. Steel Framing Installation Standard: Install steel framing to comply with ASTM C 754 and with ASTM C 840 requirements that apply to framing installation.
- B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with recommendations of gypsum board manufacturer or, if none available, with United States Gypsum Co.'s "Gypsum Construction Handbook."
- C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement. Comply with details shown on Drawings.
  - 1. Where building structure abuts ceiling perimeter or penetrates ceiling.
  - 4. Where partition framing and wall furring abut structure, except at floor.
    - a. Provide slip- or cushioned-type joints as detailed to attain lateral support and avoid axial loading.
    - b. Install deflection track top runner to attain lateral support and avoid axial loading.
    - c. Install deflection and firestop track top runner at fire-resistance-rated assemblies where indicated.
      - 1) Attach jamb studs at openings to tracks using manufacturer's standard stud clip.
- D. Do not bridge building control and expansion joints with steel framing or furring members. Independently frame both sides of joints with framing or furring members as indicated.

### 3.3 INSTALLING STEEL FRAMING FOR WALLS AND PARTITIONS

- A. Install runners (tracks) at floors, ceilings, and structural walls and columns where gypsum board stud assemblies abut other construction.
  - 1. Where studs are installed directly against exterior walls, install asphalt felt strips or foam gaskets between studs and wall.
- B. Installation Tolerances: Install each steel framing and furring member so that fastening surfaces do not vary more than 1/8 inch (3 mm) from the plane formed by the faces of adjacent framing.
- C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
  - 1. Cut studs 1/2 inch (13 mm) short of full height to provide perimeter relief.
  - 2. For STC-rated and fire-resistance-rated partitions that extend to the underside of floor/roof slabs and decks or other continuous solid structural surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed, to support gypsum board closures needed to make partitions continuous from floor to underside of solid structure.

- D. Terminate partition framing at suspended ceilings where indicated.
- E. Install steel studs and furring in sizes and at spacings indicated.
  - 1. Single-Layer Construction: Space studs 16 inches (406 mm) o.c., unless otherwise indicated.
  - 2. Multilayer Construction: Space studs 16 inches o.c., unless otherwise indicated.
  - 3. Multilayer Construction: Space studs 600 mm o.c., unless otherwise indicated.
  - 4. Cementitious Backer Unit Construction: Space studs 16 inches (406 mm) o.c., unless otherwise indicated.
  - 5. Stud space shall not exceed manufacturers recommended spacing for height of application.
- F. Install steel studs so flanges point in the same direction and leading edge or end of each gypsum board panel can be attached to open (unsupported) edges of stud flanges first.
- G. Frame door openings to comply with GA-219, and with applicable published recommendations of gypsum board manufacturer, unless otherwise indicated. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
  - 1. Install 2 studs at each jamb, unless otherwise indicated.
  - 2. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (12.7-mm) clearance from jamb stud to allow for installation of control joint.
  - 3. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above.
- H. Frame openings other than door openings to comply with details indicated or, if none indicated, as required for door openings. Install framing below sills of openings to match framing required above door heads.
- I. Install thermal insulation as follows:
  - 1. Erect insulation vertically and hold in place with Z-furring members spaced 24 inches (610 mm) o.c.
  - 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (600 mm) o.c.
  - 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw attach short flange of furring channel to web of attached channel. Start from this furring channel with standard width insulation panel and continue in regular manner. At interior corners, space second member no more than 12 inches (300 mm) from corner and cut insulation to fit.
  - 4. Until gypsum board is installed, hold insulation in place with 10-inch (250-mm) staples fabricated from 0.0625-inch (1.6-mm) diameter tie wire and inserted through slot in web of member.

### 3.4 APPLYING AND FINISHING GYPSUM BOARD, GENERAL

- A. Gypsum Board Application and Finishing Standards: Install and finish gypsum panels to comply with ASTM C 840 and GA-216.

- B. Install sound-attenuation blankets, where indicated, prior to installing gypsum panels unless blankets are readily installed after panels have been installed on one side weaved around alternating studs.
- C. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- D. Install gypsum panels with face side out. Do not install imperfect, damaged, or damp panels. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.
- E. Locate both edge or 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. Avoid joints other than control joints at corners of framed openings where possible.
- F. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- G. Attach gypsum panels to framing provided at openings and cutouts.
- H. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Instead, float gypsum panels over these members using resilient channels or provide control joints to counteract wood shrinkage.
- I. Spot grout hollow metal door frames for solid-core wood doors, hollow metal doors, and doors over 32 inches (813 mm) wide. Apply spot grout at each jamb anchor clip and immediately insert gypsum panels into frames.
- J. Form control and expansion joints at locations indicated and as detailed, with space between edges of adjoining gypsum panels, as well as supporting framing behind gypsum panels.
- K. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases that are braced internally.
  - 1. Except where concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
  - 2. Fit gypsum panels around ducts, pipes, and conduits.
  - 3. Where partitions intersect open concrete coffer, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffer, joists, and other structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.
- L. Isolate perimeter of nonload-bearing gypsum board partitions at structural abutments, except floors, as detailed. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- M. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's recommendations.
  - 1. Space screws a maximum of 8 inches o.c. for vertical applications.
- N. Space fasteners in panels that are tile substrates a maximum of 8 inches (203.2 mm) o.c.

### 3.5 GYPSUM BOARD APPLICATION METHODS

- A. Single-Layer Application: Install gypsum wallboard panels as follows:
  - 1. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated, and provide panel lengths that will minimize end joints.
  - 2. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
- B. Wall Tile Substrates: For substrates indicated to receive thin-set ceramic tile and similar rigid applied wall finishes, comply with the following:
  - 1. Install cementitious backer units to comply with ANSI A108.11 at locations indicated to receive wall tile.

### 3.6 INSTALLING TRIM ACCESSORIES

- A. General: For trim accessories with back flanges, fasten to framing with the same fasteners used to fasten gypsum board. Otherwise, fasten trim accessories according to accessory manufacturer's directions for type, length, and spacing of fasteners.
- B. Install cornerbead at all external corners.
- C. Install edge trim where edge of gypsum panels would otherwise be exposed. Provide edge trim type with face flange formed to receive joint compound, except where other types are indicated.
  - 1. Install LC-bead where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.
  - 2. Install L-bead where edge trim can only be installed after gypsum panels are installed.
  - 3. Install U-bead where indicated.
  - 4. Install aluminum trim and other accessories where indicated.
- D. Install control joints according to ASTM C 840 and manufacturer's recommendations and in specific locations approved by Architect for visual effect.
  - 1. At each side of door full height.
  - 2. At maximum 30' spacing in partitions and ceilings.
- E. Install steel battens over joints to meet US Des. 4405 for prefinished gypsum board walls.

### 3.7 FINISHING GYPSUM BOARD ASSEMBLIES

- A. General: Treat gypsum board joints, interior angles, flanges of cornerbead, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration.
- B. Prefill open joints, rounded or beveled edges, and damaged areas using setting-type joint compound.
- C. Apply joint tape over gypsum board joints, except those with trim accessories having flanges not requiring tape.

- D. Use one of the following joint compound combinations as applicable to the finish levels specified:
  - 3. Embedding and First Coat: Setting-type joint compound. Fill (Second) Coat: Setting-type joint compound. Finish (Third) Coat: Sandable, setting-type joint compound.
- E. Finish water-resistant gypsum backing board forming base for ceramic tile to comply with ASTM C 840 and gypsum board manufacturers directions for treatment of joints behind tile.
- F. Apply joint compounds and tapes on all joints above the ceiling. Bed out all nail or screw heads above the ceiling. "Fire Tape" all joints and screw heads in concealed spaces.
- G. Caulk all joints with Sound Attenuating "Acoustic Caulk" on all music practice rooms.

### 3.8 APPLYING TEXTURE FINISHES

- A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes according to texture finish manufacturer's instructions. Apply primer only to surfaces that are clean, dry, and smooth.
- B. Texture Finish Application: Mix and apply finish to gypsum panels and other surfaces indicated to receive texture finish according to texture finish manufacturer's directions. Using powered spray equipment, produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.
- C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray as recommended by texture finish manufacturer to prevent damage.
- D. Architect shall approve texture prior to final installation.

### 3.9 FIELD QUALITY CONTROL

- A. Above-Ceiling Observation: Architect will conduct an above-ceiling observation prior to installation of gypsum board ceilings and report any deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.
  - 1. Notify Architect one week in advance of the date and the time when the Project, or part of the Project, will be ready for an above-ceiling observation.
  - 2. Prior to notifying Architect, complete the following in areas to receive gypsum board ceilings:
    - a. Installation of 80 percent of lighting fixtures, powered for operation.
    - b. Installation, insulation, and leak and pressure testing of water piping systems.
    - c. Installation of air duct systems.
    - d. Installation of air devices.
    - e. Installation of mechanical system control air tubing.
    - f. Installation of ceiling support framing.

### 3.10 CLEANING AND PROTECTION

- A. Promptly remove any residual joint compound from adjacent surfaces.
- B. Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure gypsum board assemblies are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 092550

## SECTION 095113 - ACOUSTICAL PANEL CEILINGS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes ceilings consisting of acoustical panels and exposed suspension systems.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product specified.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of actual acoustical panels or sections of acoustical panels, suspension systems, and moldings showing the full range of colors, textures, and patterns available for each type of ceiling assembly indicated.
- C. Sample: Units of each type of ceiling assembly indicated; in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.
  - 1. 6-inch- (150-mm-) square samples of each acoustical panel type, pattern, and color.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed acoustical panel ceilings similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Source Limitations for Ceiling Units: Obtain each acoustical ceiling panel from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.
- C. Source Limitations for Suspension System: Obtain each suspension system from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.
  - 1. Obtain both acoustical ceiling panels and suspension system from the same manufacturer.
- D. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
  - 1. Fire-response tests were performed by UL, ITS/Warnock Hersey, or another independent testing and inspecting agency that is acceptable to authorities having jurisdiction and that performs testing and follow-up services.
  - 2. Surface-burning characteristics of acoustical panels comply with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84.



3. Fire-resistance-rated assemblies, which are indicated by design designations from UL's "Fire Resistance Directory," from ITS/Warnock Hersey's "Directory of Listed Products," or from the listings of another testing and inspecting agency, are identical in materials and construction to those tested per ASTM E 119.
4. Products are identified with appropriate markings of applicable testing and inspecting agency.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels and suspension system components to Project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

#### 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

#### 1.7 COORDINATION

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

#### 1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
  1. Acoustical Ceiling Units: Full-size units equal to 2.0 percent of amount installed.
  2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of amount installed.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those indicated for each designation in the Acoustical Panel Ceiling Schedule at the end of Part 3.

## 2.2 ACOUSTICAL PANELS, GENERAL

- A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
- B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
  - 1. Where appearance characteristics of acoustical panels are indicated by referencing ASTM E 1264 pattern designations and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range of products that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.
- C. Panel Characteristics: Comply with requirements indicated in the Acoustical Panel Ceiling Schedule at the end of Part 3, including those referencing ASTM E 1264 classifications.

## 2.3 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.
- B. Metal Suspension System Characteristics: Comply with requirements indicated in the Acoustical Panel Ceiling Schedule at the end of Part 3.
- C. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
  - 1. High-Humidity Finish: Comply with ASTM C 635 requirements for "Coating Classification for Severe Environment Performance" where high-humidity finishes are indicated.
- D. Attachment Devices: Size for five times design load indicated in ASTM C 635, Table 1, Direct Hung, unless otherwise indicated.
- E. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
  - 1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
  - 2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, Direct Hung) will be less than yield stress of wire, but provide not less than 0.106-inch- (2.69-mm-) diameter wire.
- F. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- G. Flat Hangers: Mild steel, zinc coated or protected with rust-inhibitive paint.
- H. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch thick, galvanized steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch diameter bolts.
- I. Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge

details and suspension systems indicated; formed from sheet metal of same material and finish as that used for exposed flanges of suspension system runners.

1. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
- J. Hold-Down Clips for Non-Fire-Resistance-Rated Ceilings: For interior ceilings consisting of acoustical panels weighing less than 1 lb/sq. ft., provide hold-down clips spaced 24 inches o.c. on all cross tees.
- K. Hold-Down Clips for Vestibules: For Vestibules ceilings subject to wind pressure with opening of exterior doors, provide hold-down clips spaced at 24" o.c. on all cross tees.

## 2.4 ACOUSTICAL SEALANT

- A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following requirements:
  1. Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and 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 other conditions affecting performance of acoustical panel ceilings.
  1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Coordination: Furnish layouts for cast-in-place anchors, clips, and other ceiling anchors whose installation is specified in other Sections.
  1. Furnish cast-in-place anchors and similar devices to other trades for installation well in advance of time needed for coordinating other work.
- B. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

### 3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with publications referenced below per manufacturer's written instructions and Cisca's "Ceiling Systems Handbook."
  1. Standard for Ceiling Suspension System Installations: Comply with ASTM C 636.

- 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. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  4. 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. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
  5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure; that are appropriate for substrate; and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
  6. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
  7. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, powder-actuated fasteners, or drilled-in anchors that extend through forms into concrete.
  8. Do not attach hangers to steel deck tabs.
  9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  10. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than 8 inches (200 mm) from ends of each member.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. 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, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.

3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fitted accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
  1. Arrange directionally patterned acoustical panels as follows:
    - a. Install panels with pattern running in one direction parallel to long axis of space.
  2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
  3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
  4. 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.
  5. Paint cut panel edges remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
  6. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated or required.
  7. Install clean-room gasket system in areas indicated, sealing each panel and fixture as recommended by panel manufacturer's written instructions.
  8. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

### 3.4 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

### 3.5 ACOUSTICAL PANEL CEILING SCHEDULE

- A. Water-Felted, Mineral-Base Acoustical Panel Ceiling.
  1. Products: Available product is limited to:
    - a. Armstrong Cortega #770/.
  2. Classification: Panels fitting ASTM FE 1264.
  3. Color: White
  4. Light Reflectance: .82.
  5. Noise Reduction: .55.
  6. Ceiling Attenuation Class (CAC): 33.
  7. Edge Detail: Square.
  8. Thickness: 5/8"
  9. Size: 24"x24"

10. Location: All locations noted as 24" x 24" standard acoustical ceiling. Reference Finish Schedule.

B. Water-Felted, Mineral-Base Acoustical Panel Ceiling.

1. Products: Available product is limited to:
  - a. Armstrong #1940 "Ultima" High NRC
2. Classification: Panels fitting ASTM FE 1264.
3. Color: White
4. Light Reflectance: .87.
5. Noise Reduction: .80.
6. Ceiling Attenuation Class (CAC): 35.
7. Edge Detail: Square.
8. Thickness: 1"
9. Size: 24"x24"
10. Location: Music Practice Rooms.
11. Note: This Ceiling will be provided with a double layer of insulation above the ceiling board; offset joints in insulation – caulk wall grid to wall.

3.6 DIRECT HUNG GRID SYSTEM SCHEDULE

A. Steel direct hung exposed system.

1. Products: Available products include but are not limited to:
  - a. Armstrong Prelude XL 7300 Series.
2. ASTM Class: Intermediate Duty.
3. Face Width: 15/16"
4. 6. Wall Angle: Match Grid Square Edge.
5. Location: Generally use with all Ceiling Panels.

END OF SECTION 095113



SECTION 096513 - RESILIENT WALL 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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Resilient wall base (with premolded "inside" and "outside" corners).
  - 2. Resilient flooring accessories.
  - 3. Resilient carpet accessories.
- B. Related Sections include the following:
  - 1. Division 9 Section "Resilient Tile Flooring."

1.3 SUBMITTALS

- A. Product Data: For each type of product specified.
- B. Samples for Initial Selection: Manufacturer's standard sample sets consisting of sections of units showing the full range of colors and patterns available for each type of product indicated.
- C. Samples for Verification: In manufacturer's standard sizes of each product color and pattern specified.
- D. Product Certificates: Signed by manufacturers of resilient wall base and accessories certifying that each product furnished complies with requirements.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer to perform work of this Section who has specialized in installing resilient products similar to those required for this Project and with a record of successful in-service performance.
- B. Source Limitations: Obtain each type and color of product specified from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work.
- C. Fire-Test-Response Characteristics: Provide products with the following fire-test-response characteristics as determined by testing identical products per test method indicated below by a testing and inspecting agency acceptable to authorities having jurisdiction.
  - 1. Critical Radiant Flux: 0.45 W/sq. cm or greater when tested per ASTM E 648.
  - 2. Smoke Density: Maximum specific optical density of 450 or less when tested per ASTM E 662.



1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to Project site in manufacturer's original, unopened cartons and containers, each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.
- B. Store products in dry spaces protected from the weather, with ambient temperatures maintained between 50 and 90 deg F.
- C. Move products into spaces where they will be installed at least 48 hours before installation, unless longer conditioning period is recommended in writing by manufacturer.

1.6 PROJECT CONDITIONS

- A. Maintain a temperature of not less than 70 deg F or more than 95 deg F in spaces to receive resilient products for at least 48 hours before installation, during installation, and for at least 48 hours after installation, unless manufacturer's written recommendations specify longer time periods. After postinstallation period, maintain a temperature of not less than 55 deg F or more than 95 deg F (35 deg.
- B. Do not install products until they are at the same temperature as the space where they are to be installed.
- C. For resilient products installed on traffic surfaces, close spaces to traffic during installation and for time period after installation recommended in writing by manufacturer.
- D. Coordinate resilient product installation with other construction to minimize possibility of damage and soiling during remainder of construction period. Install resilient products after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
  - 1. Furnish not less than 10 linear feet for each 500 linear feet or fraction thereof, of each different type, color, pattern, and size of resilient product installed.
  - 2. Deliver extra materials to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, those indicated in the Resilient Wall Base and Accessory Schedule at the end of Part 3.

2.2 RESILIENT WALL BASE

- A. Rubber Wall Base: Products complying with FS SS-W-40, Type I and with requirements specified in the Resilient Wall Base and Accessory Schedule.

## 2.3 RESILIENT ACCESSORIES

- A. Rubber Accessories: Products complying with requirements specified in the Resilient Wall Base and Accessory Schedule.

## 2.4 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by resilient product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where installation of resilient products will occur, with Installer present, for compliance with manufacturer's requirements, including those for maximum moisture content. Verify that substrates and conditions are satisfactory for resilient product installation and comply with requirements specified. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. General: Comply with manufacturer's written installation instructions for preparing substrates indicated to receive resilient products.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, and depressions in substrates.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- D. Broom and vacuum clean substrates to be covered immediately before installing resilient products. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.3 INSTALLATION

- A. General: Install resilient products according to manufacturer's written installation instructions.
- B. Apply resilient wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
  - 1. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
  - 2. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
  - 3. Do not stretch base during installation.

4. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient wall base with manufacturer's recommended adhesive filler material.
  5. Install premolded outside corners before installing straight pieces.
  6. Install premolded outside and inside corners before installing straight pieces.
  7. Form outside corners on job, from straight pieces of maximum lengths possible, without whitening at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
  8. Form inside corners on job, from straight pieces of maximum lengths possible, by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.
- C. Place resilient products so they are butted to adjacent materials and bond to substrates with adhesive. Install reducer strips at edges of flooring that would otherwise be exposed.

### 3.4 CLEANING AND PROTECTING

- A. Perform the following operations immediately after installing resilient products:
1. Remove adhesive and other surface blemishes using cleaner recommended by resilient product manufacturers.
  2. Sweep or vacuum horizontal surfaces thoroughly.
  3. Do not wash resilient products until after time period recommended by resilient product manufacturer.
  4. Damp-mop or sponge resilient products to remove marks and soil.
- B. Protect resilient products against mars, marks, indentations, and other 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 resilient product manufacturer.
1. Apply protective floor polish to vinyl resilient products installed on floors and stairs that are free from soil, visible adhesive, and surface blemishes, if recommended by manufacturer.
    - a. Use commercially available product acceptable to resilient product manufacturer.
    - b. Coordinate selection of floor polish with Owner's maintenance service.
  2. Cover resilient products installed on floors and stairs with undyed, untreated building paper until inspection for Substantial Completion.
- C. Clean resilient products not more than 4 days before dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean products according to manufacturer's written recommendations.
1. Before cleaning, strip protective floor polish that was applied to vinyl products on floors and stairs after completing installation only if required to restore polish finish and if recommended by resilient product manufacturer.
  2. After cleaning, reapply polish on vinyl products on floors and stairs to restore protective floor finish according to resilient product manufacturer's written recommendations. Coordinate with Owner's maintenance program.

3.5 RESILIENT WALL BASE AND ACCESSORY SCHEDULE

- A. Rubber Wall Base: Where this designation is indicated, provide rubber wall base complying with the following:
1. Manufacturers
    - a. Flexco Div. Textile Rubber Co.
    - b. Johnsonite Flooring Co.
    - c. Roppe Rubber Corp.
  2. Color and Pattern: As selected by Architect from manufacturer's full range of colors and patterns produced for rubber wall base complying with requirements indicated
  3. Style: Cove with top-set toe
  4. Minimum Thickness: 1/8 inch
  5. Height: 4 inches
  6. Lengths: Coils in lengths standard with manufacturer, but not less than 96 feet.
  7. Outside Corners: Premolded.
  8. Inside Corners: Premolded.
  9. Surface: Matte finish.
- B. Rubber Accessory Molding: Where this designation is indicated, provide rubber accessory molding complying with the following:
1. Manufacturers:
    - a. Flexco Div. Textile Rubber Co.
    - b. Johnsonite Flooring Co.
    - c. Roppe Rubber Corp.
  2. Color: As selected by Architect from manufacturer's full range of colors produced for rubber accessory molding complying with requirements indicated.
  3. Product Description: Carpet edge for glue-down applications.
  4. Carpet nosing
  5. Reducer strip for resilient flooring or exposed concrete.
  6. Tile and carpet joiner.
  7. Profile and Dimensions: As specified by product designation indicated above

END OF SECTION 096513



## SECTION 096813 - 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, tufted carpet tile and rubber edging/nosing.
- B. Related Requirements:
  - 1. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

#### 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 installation recommendations for each type of substrate.
- B. Shop Drawings: Show the following:
  - 1. Carpet tile type, color, and dye lot.
  - 2. Type of installation.
  - 3. Pattern of installation.
  - 4. Pattern type, location, and direction.
  - 5. Pile direction.
  - 6. Type, color, and location of insets and borders.
  - 7. Type, color, and location of edge, transition, and other accessory strips.
  - 8. 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 Tile: Full-size Sample.
  - 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- long Samples.
- D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

- B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.
- C. Sample Warranty: For special warranty.

#### 1.5 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.

#### 1.6 MAINTENANCE MATERIAL SUBMITTALS

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

#### 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.
- B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.
- C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
  - 1. Build mockups at locations as directed by the Architect, showing carpet tile color and pattern, and edgings.
  - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104.

#### 1.9 FIELD CONDITIONS

- A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at occupancy levels during the remainder of the construction period.

- C. Do not install carpet 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.

#### 1.10 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 edge raveling, snags, runs, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber, and delamination.
  - 3. Warranty Period: Lifetime from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 CARPET TILE

- A. Products: Subject to compliance with requirements, provide the following:
  - 1. Milliken and Company; Way Collection; Forcefield Dark Design.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
  - 1. Milliken and Company; Way Collection; Forcefield Dark Design.
- C. Color: As selected by Architect from manufacturer's full range.
- D. Pattern: Way Collection.
- E. Fiber Content: 100 percent nylon 6, 6.
- F. Fiber Type: Nylon Type 6,6.
- G. Pile Characteristic: Tufted, textured pile.
- H. Density: 197, 121.
- I. Pile Thickness: 0.27 inch for finished carpet tile according to ASTM D 6859.
- J. Stitches: 14.4.
- K. Gage: 1/10.
- L. Total Weight: 86.7 for finished carpet tile.
- M. Primary Backing/Backcoating: Manufacturer's standard composite materials.



- N. Secondary Backing: Manufacturer's standard material.
- O. Size: 36 by 36 inches.
- P. Applied Soil-Resistance Treatment: Manufacturer's standard material.
- Q. Antimicrobial Treatment: Manufacturer's standard material.
- R. Performance Characteristics: As follows:
  - 1. Appearance Retention Rating: Severe traffic, 3.5 minimum according to ASTM D 7330.
  - 2. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm.
  - 3. Dimensional Tolerance: Within 1/32 inch of specified size dimensions, as determined by physical measurement.
  - 4. Dimensional Stability: 0.2 percent or less according to ISO 2551 (Aachen Test).
  - 5. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
  - 6. Colorfastness to Light: Not less than 4 after 80 AFU (AATCC fading units) according to AATCC 16, Option E.
  - 7. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.
  - 8. Emissions: Provide carpet tile that complies with testing and product requirements of CRI's "Green Label Plus" program.

## 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 complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.
  - 1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Rubber Transition Strips: Provide preformed rubber transition strips between carpet tiles and other flooring materials as per carpet tile Manufacturer's recommendation. Color to be selected from Manufacturer's full range of colors.

## 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. Examine carpet tile for type, color, pattern, and potential defects.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
  2. Subfloor finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" for slabs receiving carpet tile.
  3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. General: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.
- C. Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by carpet tile manufacturer.
- D. Clean metal substrates of grease, oil, soil and rust, and prime if directed by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.
- E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

### 3.3 INSTALLATION

- A. General: Comply with CRI 104, Section 14, "Carpet Modules," 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 finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
- G. Install pattern parallel to walls and borders.

- H. Stagger joints of carpet tiles so carpet tile grid is offset from access flooring panel grid. Do not fill seams of access flooring panels with carpet adhesive; keep seams free of adhesive.

### 3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
  - 1. Remove excess adhesive, seam sealer, 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 104, Section 16, "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 096813

SECTION 099100 - PAINTING

PART 1 - GENERAL

1.1 RELATED INFORMATION

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Reference Finish Schedule for areas of accent color patterns and striping.

1.2 SUMMARY

- A. This Section includes surface preparation and field painting of the following:
  - 1. Exposed interior items and surfaces.
  - 2. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
  - 3. Paint exposed ceiling structure and mechanical ducts – Dry Fog full ceiling and structure area and old ceiling to remain.
- B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available.
  - 1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
  - 1. Prefinished items include the following factory-finished components:
    - a. Architectural woodwork and casework.
    - b. Acoustical wall panels.
    - c. Finished mechanical and electrical equipment. (Except exposed duct work and grills/register)
    - d. Light fixtures.
    - e. Distribution cabinets.
  - 2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
    - a. Foundation spaces.
    - b. Furred areas.
    - c. Ceiling plenums.
    - d. Utility tunnels.
    - e. Pipe spaces.
    - f. Duct shafts.
  - 3. Finished metal surfaces include the following:

- a. Anodized aluminum.
    - b. Stainless steel.
    - c. Chromium plate.
    - d. Copper.
    - e. Bronze and brass.
  4. Operating parts include moving parts of operating equipment and the following:
    - a. Valve and damper operators.
    - b. Linkages.
    - c. Sensing devices.
    - d. Motor and fan shafts.
  5. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
- D. Related Sections include the following:
1. Division 2 Section "Portland Cement Concrete Paving" for traffic-marking paint.
  2. Division 5 Section "Structural Steel" for shop priming structural steel.
  3. Division 5 Section "Metal Fabrications" for shop priming ferrous metal.
  4. Division 8 Section "Steel Doors and Frames" for shop priming steel doors and frames.
  5. Division 9 Section "Gypsum Board Assemblies" for surface preparation for gypsum board.

### 1.3 DEFINITIONS

- A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
  2. Eggshell refers to low-sheen finish with a gloss range between 5 and 20 when measured at a 60-degree meter.
  3. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.
  4. Semi-gloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.
  5. Full gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

### 1.4 SUBMITTALS

- A. Product Data: For each paint system specified. Include block fillers and primers.
1. Material List: Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
  2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
- B. Samples for color Selection: Manufacturer's color charts showing the full range of colors available for each type of finish-coat material indicated.

## 1.5 QUALITY ASSURANCE

- A. Applicator Qualifications: Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in-service performance.
- B. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
  - 1. Product name or title of material.
  - 2. Product description (generic classification or binder type).
  - 3. Manufacturer's stock number and date of manufacture.
  - 4. Contents by volume, for pigment and vehicle constituents.
  - 5. Thinning instructions.
  - 6. Application instructions.
  - 7. Color name and number.
  - 8. VOC content.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F (7 deg C). Maintain containers used in storage in a clean condition, free of foreign materials and residue.
  - 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

## 1.7 PROJECT CONDITIONS

- A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F (10 and 32 deg C).
- B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F (7.2 and 35 deg C).
- C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.
  - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

## 1.8 EXTRA MATERIALS

- A. Furnish extra paint materials from the same production run as the materials applied in the quantities described below. Package paint materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to the Owner.
  - 1. Quantity: Furnish the Owner with an additional 5 percent, but not less than 1 gal. (3.785 L) or 1 case, as appropriate, of each material and color applied.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements Paint Manufacturer Specified for Quality is Kelley Moore, which is the MSU constructed standard. Other products are required to provide information qualifying equal product to specified product. Items incorporated into the work by the following manufacturers provided they show compliance with Kelley Moore product:
  - 1. DEVOE
  - 2. Sherwin Williams
  - 3. ICI
  - 4. Benjamin Moore
  - 5. PPG

### 2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
  - 1. DEVOE
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
  - 1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
- C. Colors: Match colors indicated by reference to manufacturer's color designations.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.
  - 1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
  - 2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

1. Notify the Architect about anticipated problems using the materials specified over substrates primed by others.

### 3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

- B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.

1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

1. Provide barrier coats over incompatible primers or remove and reprime.
2. Cementitious Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
  - a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
  - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.
  - c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.
3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
  - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
  - b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and backsides of wood, including cabinets, counters, cases, and paneling. All surfaces of wood are to be primed and sealed including non-exposed surfaces. All exposed surfaces are to be Primed, stained and sealed.
  - c. When transparent finish is required, backprime with spar varnish.



- d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on backside.
    - e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.
  - 4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.
    - a. Blast steel surfaces clean as recommended by paint system manufacturer and according to requirements of SSPC-SP 10.
    - b. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
    - c. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.
  - 5. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- D. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
  - 1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
  - 2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
  - 3. Use only thinners approved by paint manufacturer and only within recommended limits.
- E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

### 3.3 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
  - 1. Paint colors, surface treatments, and finishes are indicated in the schedules.
  - 2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
  - 3. Provide finish coats that are compatible with primers used.
  - 4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convactor covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
  - 5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  - 6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.

7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
  8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
  9. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
  10. Sand lightly between each succeeding enamel or varnish coat.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
  2. Omit primer on metal surfaces that have been shop primed and touchup painted.
  3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
  4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.
- C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brushes: Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.
  2. Rollers: Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.
  3. Spray Equipment: Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.
- D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.
- E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.
- F. Exposed Mechanical items to be painted include, but are not limited to, the following:
1. Piping, pipe hangers, and supports.
  2. Ductwork.
  3. Insulation.
  4. Accessory items.
- G. Electrical items to be painted include, but are not limited to, the following:
1. Conduit and fittings.
- H. Structural items to be painted include, but are not limited to, the following:
1. Columns

2. Beams
  3. Perlins
  4. Exposed structural supports, hangers and miscellaneous
- I. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
  - J. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.
  - K. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
  - L. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.
    1. Provide satin finish for final coats.
  - M. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.
  - N. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

#### 3.4 FIELD QUALITY CONTROL

- A. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary during the period when paint is being applied:
  1. The Owner will engage the services of an independent testing agency to sample the paint material being used. Samples of material delivered to the Project will be taken, identified, sealed, and certified in the presence of the Contractor.
  2. The testing agency will perform appropriate tests for the following characteristics as required by the Owner:
    - a. Quantitative material analysis.
    - b. Abrasion resistance.
    - c. Apparent reflectivity.
    - d. Flexibility.
    - e. Washability.
    - f. Absorption.
    - g. Accelerated weathering.
    - h. Dry opacity.
    - i. Accelerated yellowness.
    - j. Recoating.
    - k. Skinning.
    - l. Color retention.
    - m. Alkali and mildew resistance.

3. The Owner may direct the Contractor to stop painting if test results show material being used does not comply with specified requirements. The Contractor shall remove non-complying paint from the site, pay for testing, and repaint surfaces previously coated with the rejected paint. If necessary, the Contractor may be required to remove rejected paint from previously painted surfaces if, on repainting with specified paint, the 2 coatings are incompatible.

### 3.5 CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.
  1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

### 3.6 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
  1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

### 3.7 INTERIOR PAINT SCHEDULE:

- A. Concrete Masonry Units (block not factory colored and finished), painted as follows:
  1. 1<sup>st</sup> coat: 122 Kel Pro Acrylic Block Filler.
  2. 2<sup>nd</sup> coat: 1007 Ezy-Cote Int. Acrylic Latex.
  3. 3<sup>rd</sup> coat: 1007 Ezy-Cote Int. Acrylic Latex.
- B. Gypsum Board, ceilings as follows:
  1. 1<sup>st</sup> coat: 1005 KM Pro Latex FWP.
  2. 2<sup>nd</sup> coat: 1005 KM Pro Latex FWP.
- C. Gypsum Board, walls, Semi-Gloss Finish/Acrylic as follows:
  1. 1<sup>st</sup> coat: 970 Acry-Plex High Hide Primer.
  2. 2<sup>nd</sup> coat: Dura-poxy 1686-121.
  3. 3<sup>rd</sup> coat: Dura-poxy 1686-121.
- D. Woodwork and Hardboard as follows:
  1. 1<sup>st</sup> coat: 985 Flo-Cote Enamel Undercoat.
  2. 2<sup>nd</sup> coat: Dura-poxy 1686-121.
  3. 3<sup>rd</sup> coat: Dura-poxy 1686-121.

E. Stained Woodwork as follows:

1. Alkyd-Based, Satin Varnish: 2 coats clear-satin varnish over sealer and wood stain.
2. Waterborne, Satin Varnish: 2 coats clear-satin varnish over sealer and wood stain.
3. Water-Based, Full Gloss, Varnish: 2 coats Full-Gloss varnish over sealer and wood stain.
4. Alkyd-Based Stain, Wax-Polished Finish: 3 coats paste wax over sealer and wood stain.

F. Natural-Finish Woodwork as follows:

1. Alkyd-Based, Stain Varnish: 2 coats clear-satin varnish over sealer.
2. Waterborne, Satin Varnish: 2 coats clear-satin varnish over sealer.
3. Water-Based, Full Gloss, Varnish: 2 coats Full-Gloss varnish over sealer.
4. Wax-Polished Finish: 3 coats paste wax over sealer.

G. Ferrous Metal as follows:

1. 1<sup>st</sup> coat: 5725 Acrylic Primer/Finish, Acrylic Direct to Metal Primer.
2. 2<sup>nd</sup> coat: 1649 Pro Enamel.
3. 3<sup>rd</sup> coat: 1649 Pro Enamel.

H. Zinc-coated Metal as follows:

1. Semi Gloss, Acrylic Enamel: 2 coats over primer.
2. Semi Gloss, Acrylic Enamel: 2 coats over under-coater and primer.

I. Dry Fog Spray

1. Equal to PPG Speedhide Flat Latex Dry-Fog.

END OF SECTION 099100

## SECTION 099500 - WALL COVERINGS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Wall Carpet
  - 2. Acoustical Surfacing
    - a. Sound Board Insulation Backing.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
  - 1. Division 9 Section "Painting" for primers, coatings, and paint for woven glass-fiber wall coverings.
  - 2. Division 9 Section "Painting" for priming wall surfaces.

#### 1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for each type of product specified. Include data on physical characteristics, durability, fade resistance, and flame-resistance characteristics.
- C. Shop Drawings showing location and extent of each wall covering type. Indicate seams and termination points.
- D. Samples for initial selection in the form of manufacturer's color charts consisting of actual units or sections of units showing the full range of colors, textures, and patterns available.
- E. Samples for verification in sets for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.
  - 1. Wall Covering Material: Full-width sample, not less than 36 inches (914 mm) long, from dye lot used for the Work.
    - a. Submit sample with specified treatments applied.
    - b. Mark top and face of material.
    - c. Show complete pattern repeat.
  - 2. Woven Glass-Fiber Wall Covering Material: Full-width sample, not less than 36 inches (914 mm) long with specified paint applied.
- F. Schedule of wall coverings using same room designations indicated on Drawings.

- G. Product certificates signed by manufacturers of wall coverings certifying that their products comply with specified requirements.
- H. Maintenance data for wall covering to include in the operation and maintenance manual specified in Division 1.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed 5 projects similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Fire-Test-Response Characteristics: Provide wall coverings with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
  - 1. Flame Spread: 25 or less.
  - 2. Smoke Developed: 450 or less.

#### 1.5 PROJECT CONDITIONS

- A. Lighting: Do not install wall covering until a lighting level of not less than 15 foot-candles (160 lux) is provided on the surfaces to receive wall covering.
- B. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by the wall covering manufacturer for full drying or curing.

#### 1.6 EXTRA MATERIALS

- A. Furnish extra materials described below, before installation begins, that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
  - 1. Rolls of Wall Covering Material: Full-size units equal to 5 percent of amount of each type installed.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, wall coverings that may be incorporated into the Work include, but are not limited to, the products specified in each wall covering Product Data sheet at end of this Section.

#### 2.2 ADHESIVES

- A. General: Mildew-resistant, nonstaining adhesive, for use with specific wood-veneer wall covering and substrate application, as recommended by wall covering manufacturer.

## 2.3 ACCESSORIES

- A. Wall Liner: Nonwoven, synthetic underlayment and adhesive as recommended by wall covering manufacturer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for moisture content and other conditions affecting performance of Work of this Section. Do not proceed with installation until 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 wall covering's bond, including mold, mildew, oil, grease, incompatible primers, and dirt.
- C. Prepare substrates to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, and defects.
  - 1. Painted Surfaces: Treat areas susceptible to pigment bleeding.
  - 2. Metals: If not factory primed, clean and apply rust-inhibitive zinc primer.
  - 3. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
  - 4. Prime new gypsum board with primer recommended by wall covering manufacturer.
  - 5. Allow new plaster to cure. Treat areas of high alkalinity.
- D. Check painted surfaces for pigment bleeding. Sand gloss, semigloss, and eggshell finishes with fine sandpaper.
- E. Install wall liner, with no gaps or overlaps, where required by wall covering manufacturer. Form smooth wrinkle-free surface for finished installation. Do not begin wall covering installation until wall liner has dried.
- F. Acclimatize wall covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.
- G. Coordinate wall covering installation with Acoustical Wall Board texture treatment.

### 3.3 INSTALLATION, GENERAL

- A. General: Comply with wall coverings manufacturers' written installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
- B. Cut wall covering panels in roll number sequence. Change run numbers at partition breaks and corners only.
- C. Install wall covering with no gaps or overlaps.



- D. Match pattern 72 inches (1830 mm) above finish floor.
- E. Install seams vertical and plumb at least 6 inches (150 mm) from outside corners and 3 inches (75 mm) from inside corners. No horizontal seams.
- F. Remove air bubbles, wrinkles, blisters, and other defects.
- G. Trim edges for color uniformity, pattern match, and tight closure at seams and edges. Butt seams.

### 3.4 CLEANING

- A. Remove excess adhesive at finished seams, perimeter edges, and adjacent surfaces.
- B. Use cleaning methods recommended by wall covering manufacturer.
- C. Replace strips that cannot be cleaned.

### 3.5 WALL COVERING PRODUCTS

- A. Wall covering type #1 (for use in Practice Rooms and other areas as designated by the drawings and "Finish Schedule," Section 099990)
  - 1. Manufacturer: Hytex Textiles (Koroseal).
  - 2. Pattern: "Whispertex 3 Inspiration"; Wall Carpet
  - 3. Total weight: 13 oz.
  - 4. Roll width: 53/54"
  - 5. NRC: ASTM C-423: .60
  - 6. Fabric: Fossfibre® - Solution Dyed.
  - 7. Federal Spec: CFFA-W-408A, Type II
  - 8. CFFA Spec: Class A.
  - 9. U.L.. Rating: ASTM E-84 Tunnel Test.
  - 10. Flame Spread: 15
  - 11. Smoke Developed: 20
- B. Installed over 1" Acoustical Wall Board – Duct board.

END OF SECTION 09950

**FINISH SCHEDULE - PROJECT NAME**

ROOM NAME	ROOM NO	FL+D2:K 35R.	BASE	NORTH WALL	EAST WALL	SOUTH WALL	WEST WALL	CLG. FIN	CLG. HT.	REMARKS
CORRIDOR	1CORR4	1A	2A	3A	3A	3A	3A	4A	—	R1
CORRIDOR	1CORR5	1A	R6	—	—	—	3B	—	—	R6
FOYER	C100	1A	2A	3A	3A	3A	3A	4A	—	R1
AVID A	C102A	1B	2B	3B	3B	3B	3B	4B	R3	
SERVERS	C115I	NO WORK IN THIS AREA								R1
INSTRUMENT LOUNGE	C116	1A	2B	3C	3B	3C	3C	4C	EXISTING	
PRACTICE ROOM	C116A	1C	2C	3D	3D	3D	3D	4D	R3	R4, R5
FOYER	D102	NO WORK IN THIS AREA								
PRACTICE ROOM	501	1C	2C	3D	3D	3D	3D	4D	8' - 0"	R4, R5
PRACTICE ROOM	502	1C	2C	3D	3D	3D	3D	4D	8' - 0"	R4, R5
PRACTICE ROOM	503	1C	2C	3D	3D	3D	3D	4D	8' - 0"	R4, R5
PRACTICE ROOM	504	1C	2C	3D	3D	3D	3D	4D	8' - 0"	R4, R5
PRACTICE ROOM	505	1C	2C	3D	3D	3D	3D	4D	8' - 0"	R4, R5
DRAWING STUDIO	506	1B	2B	3B	3B	3B	3B	4B	R3	R7
DRAWING STUDIO	507	1B	2B	3B	3B	3B	3B	4A	EXISTING	R7
CORRIDOR	508	1A	R6	3B	3B	3B	3B	—	—	R6, R8



**FINISH SCHEDULE KEY**

**1. FLOORS**

- 1A.** Existing Floor Finish to Remain.
- 1B.** Polished Exposed Concrete - Sealed.
- 1C.** Carpet Tiles.

**2. BASE**

- 2A.** Existing Base to remain.
- 2B.** 6"H. Rubber Cove Base.
- 2C.** 4" Wood Base – Painted (to trim Acoustical Wall Treatment)

**3. WALLS**

- 3A.** Existing Wall Finish to remain.
- 3B.** Gypsum Board – Texture & Paint.
- 3C.** Existing wall – Paint & texture to match existing.
- 3D.** Acoustic wall treatment over Duct Board.

**4. CEILING:**

- 4A.** Existing Ceiling to remain – Paint Dry Fog.
- 4B.** 2' x 2' Lay-in Suspended Acoustical Ceiling (beveled tegular) in a painted steel grid with 3½" batt insulation above.
- 4C.** Exposed Roof Structure – paint Dry Fog.
- 4D.** New 2' x 2' Ceiling Tiles lay-in Suspended Acoustical with 2 layers of 3 ½" batt insulation above.

**REMARKS**

- R1.** Paint Door Frame into work area.
- R2.** Texture & Paint furr-down.
- R3.** Ceiling to be as high as possible.
- R4.** Wood Trim 1 x 2 at all corners, joints, ceiling, doors; to adhere Acoustical Wall treatment paint.
- R5.** Caulk all joints with Acoustic Caulk; walls, ceilings, door frame(s).
- R6.** Paint only side of corridor to receive work; base to match existing as closely as possible; reuse existing salvaged during demolition.
- R7.** Paint Window frames on existing partition wall; repair wall around frame and at location of demolition from previous adjacent partition and faux-wall texture.
- R8.** Paint Corridor – Protect existing Tack Boards/Wall Plaques and Signs from paint and damage during construction.

END OF SECTION 099990



## SECTION 104250 - SIGNS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following types of signs:

- 1. Panel signs

#### 1.3 SUBMITTALS

- A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for each type of sign specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.
- C. Shop drawings showing fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, grounds, layout, reinforcement, accessories, and installation details.
  - 1. Provide message list for each sign required, including large-scale details of wording and lettering layout.
  - 2. For signs supported by or anchored to permanent construction, provide setting drawings, templates, and directions for installation of anchor bolts and other anchors to be installed as a unit of Work in other Sections.

#### 1.4 QUALITY ASSURANCE

- A. Sign Fabricator Qualifications: Firm experienced in producing signs similar to those indicated for this Project, with a record of successful in-service performance, and sufficient production capacity to produce sign units required without causing delay in the Work.
- B. Single-Source Responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
  - 1. Manufacturers of Panel Signs:
    - a. APCO Graphics, Inc.
    - b. ASI Sign Systems, Inc.
    - c. Best Manufacturing Company.

## 2.2 MATERIALS

- A. Photo Polymer sheet consisting of minimum 0.032 inch thick moisture resistant, non-glare nylon polymer on ultraviolet resistant clear PETS sign base, single piece construction. Thickness shall be 1/8 inch with color to be selected from Manufacturer's full range of colors.
- B. Anchors and Inserts: Use nonferrous metal or hot-dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

## 2.3 PANEL SIGNS

- A. Panel Signs: Fabricate signs by photo polymer process using film negatives to produce characters and graphics in contrasting color, raised 1/16 inch.
  - 1. Signs shall be ADA and TAS compliant.
- B. Characters:
  - 1. Height: 5/8 inch.
  - 2. Style: Sans Serif Style to match existing, upper case.
  - 3. Width to Height Ratio: Between 3:5 and 1:1.
  - 4. Stroke width to Height Ratio: Between 1:5 to 1:10.
- C. Provide Braille indications for each other.
- D. Corners: Square
- E. Edges: Square.
- F. Changeable Slide Inserts: Polycarbonate cover with slot behind for insertion of changeable slide strip removed from side.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions and according to ADA / TAS compliant heights.
  - 1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance.
- B. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using the methods indicated below:
  - 1. Vinyl-Tape Mounting: Use double-sided waterproof, pressure sensitive foam tape to mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.

3.2 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to the manufacturer's instructions. Protect units from damage until acceptance by the Owner.

3.3 Schedule:

A. Standard Rooms

- 1. Size: 6 x 12 inches
- 2. Content: Room Number and changeable slide strip.
- 3. Quantity: 15

END OF SECTION 104250





## SECTION 104413 - FIRE-PROTECTION SPECIALTIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Portable fire extinguishers.
  - 2. Fire-protection cabinets for the following:
    - a. Portable fire extinguishers.

#### 1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection specialties.
  - 1. Fire Extinguishers: Include rating and classification.
  - 2. Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
  - 3. Show location of knockouts for hose valves.
- B. Samples for Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of cabinet finish indicated.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain fire extinguishers and cabinets through one source from a single manufacturer.
- B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."
- C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
  - 1. Provide extinguishers listed and labeled by FM.

#### 1.5 COORDINATION

- A. Coordinate size of cabinets to ensure that type and capacity of fire extinguishers indicated and provided by Owner under separate Contract are accommodated.
- B. Coordinate size of cabinets to ensure that type and capacity of hoses, hose valves, and hose racks indicated are accommodated.

## PART 2 – PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Portable Fire Extinguishers:
    - a. J.L. Industries, Inc.
    - b. Larsen's Manufacturing Company.
  - 2. Fire-Protection Cabinets:
    - a. J.L. Industries, Inc.
    - b. Larsen's Manufacturing Company.
- B. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified in the Fire-Protection Cabinet Schedule at the end of Part 3.

### 2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: Carbon steel, complying with ASTM A 366/A 366M, commercial quality, stretcher leveled, temper rolled.

### 2.3 PORTABLE FIRE EXTINGUISHERS

- A. General: Provide fire extinguishers of type, size, and capacity for each cabinet and other locations indicated.
- B. Multipurpose Dry-Chemical Type: UL-rated 4-A:60-B:C, 10-lb (4.5-kg) nominal capacity, in enameled-steel container.

### 2.4 FIRE-PROTECTION CABINETS

- A. Cabinet Construction: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.
  - 1. Cabinet Metal: Enameled-steel sheet.
  - 2. Shelf: Same metal and finish as cabinet.
  - 3. Fire-rated for 1-hr. or 2-hr. firewall applications (where indicated in Fire-Protection Cabinet Schedule).
- B. Cabinet Type: Suitable for the following:
  - 1. Multipurpose ABC 10# Fire Extinguisher.
- C. Cabinet Mounting: Suitable for the following mounting conditions:
  - 1. Recessed: Cabinet box recessed in walls of shallow depth to suit style of trim indicated.
- D. Cabinet Trim Style: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

1. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
  - a. Rolled Edge: 2 ½" – maximum 4" deep rough opening.
- E. Cabinet Trim Material: Manufacturer's standard, Same metal and finish as door.
- F. Door Material: Manufacturer's standard Steel sheet.
- G. Door Glazing: Manufacturer's standard, as follows:
  1. Tempered Float Glass: Class 1 (clear) ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, as follows:
- H. Door Style: Manufacturer's standard design: Vertical Duo.
- I. Door Construction: Fabricate doors according to manufacturer's standards, of materials indicated, and coordinated with cabinet types and trim styles selected.
- J. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam-action latch, or exposed or concealed door pull and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 degrees.

## 2.5 ACCESSORIES

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure extinguisher, of sizes required for types and capacities of extinguishers indicated, with plated or baked-enamel finish.
  1. Provide brackets for extinguishers not located in cabinets.
- B. Identification: Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location. Locate as indicated by Architect.
  - . Identify fire extinguisher in cabinet with the words "FIRE EXTINGUISHER" applied to door.
    - a. Application Process: Silk-screened.
    - b. Lettering Color: Selected by Architect
    - c. Orientation: Vertical.

## 2.6 COLORS AND TEXTURES

- A. Colors and Textures: As selected by Architect from manufacturer's full range for these characteristics.

## 2.7 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Cabinet and Door Finishes: Provide manufacturer's standard baked-enamel paint for the following:
  - 1. Exterior of cabinets and doors, except for those surfaces indicated to receive another finish.
  - 2. Interior of cabinets and doors.
- E. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's specifications for cleaning, conversion coating, and painting.
  - 1. Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 603.8 except with a minimum dry film thickness of 1.5 mils, medium gloss.
  - 2. Color: As selected by Architect from manufacturer's full range.

## 2.8 STEEL FINISHES

- A. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond using manufacturer's standard methods.
- B. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment.
  - 1. Shop Primer: Manufacturer's or fabricator's standard, fast-curing, lead- and chromate-free, universal primer, selected for resistance to normal atmospheric corrosion, for compatibility with substrate and field-applied finish paint system indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.
- C. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.
  - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where recessed and semi recessed cabinets are to be installed.
- B. Examine fire extinguishers for proper charging and tagging. Remove and replace damaged, defective, or undercharged units.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing fire-protection specialties.
- B. Install in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
  - 1. Prepare recesses for cabinets as required by type and size of cabinet and trim style.
  - 2. Fasten mounting brackets to structure and cabinets, square and plumb.
  - 3. Fasten cabinets to structure, square and plumb.

### 3.3 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust cabinet doors that do not swing or operate freely.
- B. Refinish or replace cabinets and doors damaged during installation.
- C. Provide final protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of Substantial Completion.

### 3.4 FIRE-PROTECTION CABINET SCHEDULE

- A. Fire-Protection Cabinet FEC: Where this designation is indicated, provide five (2) fire-protection cabinets and fire extinguishers complying with the following:
  - 1. Products: Larsen's 2409-6R or equal.
  - 2. Construction: Nonrated.
  - 3. Cabinet Material: Enameled-steel sheet
  - 4. Type: Fire extinguisher shall be Larsen's MP10 or equal
  - 5. Mounting: Recessed
  - 6. Trim Style: Exposed
    - a. Exposed Trim: 2-½" Rolled Edge
  - 7. Cabinet Trim Material: Steel sheet
  - 8. Door Material: Steel sheet
  - 9. Door Glazing: 1/8" thick Tempered float glass
  - 10. Door Style: Vertical Duo
  - 11. Accessories: Mounting brackets; Identification lettering.
  - 12. Color and Texture: As selected by Architect from manufacturer's full range.
    - a. Steel Finish: Baked enamel.

### 3.5 FIRE EXTINGUISHER SCHEDULE

- A. Fire extinguisher FE: where this designation is indicated, provide twelve (2) fire extinguishers complying the following; to be with the cabinets alone.
  - 1. Products: Larsen's MP10 or equal
  - 2. Construction: Enameled-steel container
  - 3. Location: Location and mounting height as directed by Architect.
  - 4. Surface mounting bracket by extinguisher manufacturer.

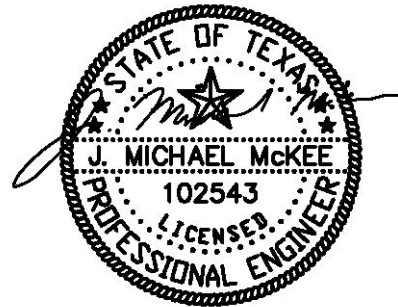
END OF SECTION 104413



**DIVISION 23 - MECHANICAL**

Division	Section Title	Pages
230713.....	DUCT INSULATION.....	13
233113.....	METAL DUCTS.....	12
233300.....	AIR DUCT ACCESSORIES.....	6
233713.....	DIFFUSERS, REGISTERS, AND GRILLES.....	3

By: J. Michael McKee, PE., #102543  
Campos Engineering, Inc.  
Registration No. F-001731  
1331 River Bend Drive  
Dallas, Tx 75247  
Ph: 214-696-6291





THIS PAGE IS INTENTIONALLY LEFT BLANK

Copyright 2011 by The American Institute of Architects (AIA)

Exclusively published and distributed by Architectural Computer Services, Inc. (ARCOM) for the AIA

## SECTION 230713 - DUCT INSULATION

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term "Architect." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

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

#### 1.2 SUMMARY

- A. Section includes insulating the following duct services:

The list below matches the various systems in the schedule articles. Coordinate the revision of list with "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles.

- 1. Indoor, concealed supply and outdoor air.

- B. Related Sections:

Retain Sections in subparagraphs below that contain requirements Contractor might expect to find in this Section but are specified in other Sections.

- 1. Section 233113 "Metal Ducts" for duct liners.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

#### 1.4 QUALITY ASSURANCE

Retain first paragraph below if available at Project location. Apprenticeship programs are usually associated with union shops. Other craft training programs are available.

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

When fire-performance characteristics are important requirements, verify surface-burning characteristics of insulation materials by an independent testing agency and require test report submittals.

- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

Retain this article to require shipping container markings. Container marking is an option in ASTM standards; default condition does not include the marking in this article unless specified in the Contract.

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

#### 1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

## 1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## PART 2 - PRODUCTS

### 2.1 INSULATION MATERIALS

If retaining more than one type of insulation in this article, indicate where each type applies in insulation system schedules.

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

See "Product Characteristics" Article in the Evaluations for comparisons and temperature ranges for insulation material properties.

- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

For operating temperatures higher than 250 deg F (121 deg C), use blanket insulation in first paragraph below. Retain ASTM C 1290 types as follows: Type I for insulation without jackets, Type II for insulation with vinyl jackets, and Type III for insulation with FSK or FSP jackets.

- F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

- 1. Products: Subject to compliance with requirements, provide one of the following:
  - a. CertainTeed Corporation; SoftTouch Duct Wrap.
  - b. Johns Manville; a Berkshire Hathaway company; Microlite.
  - c. Knauf Insulation; Atmosphere Duct Wrap with ECOSE Technology.

- d. [Manson Insulation Inc](#); Alley Wrap.
- e. [Owens Corning](#); SOFTR All-Service Duct Wrap.

## 2.2 ADHESIVES

Military Specification in this article was the only standard available when this Section was written. MIL-A-3316C was last updated in October 1987.

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

- 1. [Products](#): Subject to compliance with requirements, provide one of the following:
  - a. [Childers Brand; H. B. Fuller Construction Products](#); CP-127.
  - b. [Eagle Bridges - Marathon Industries](#); CP-127.Eagle Bridges - Marathon Industries; 225..
  - c. [Foster Brand; H. B. Fuller Construction Products](#); 85-60/85-70.
  - d. [Mon-Eco Industries, Inc](#); 22-25.

One or both subparagraphs below may be required to comply with Project requirements or authorities having jurisdiction. Retain first subparagraph below if required for LEED-NC, LEED-CI, or LEED-CS Credit IEQ 4.1.

- 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.3 MASTICS

The industry does not have a clear definition that categorizes mastics into vapor barriers, vapor retarders, and breather mastics. Specification follows the nomenclature used by Foster. Products with a perm rating of 0.1 and lower are considered vapor barriers. Products with a perm rating greater than 0.1 and less than 1.0 are considered vapor retarders. Products with a perm rating greater than 1.0 are called "breathable." Consider ambient conditions and operating temperatures when selecting a mastic. Consider using water-based mastics for environmental reasons.

LEED Credit IEQ 4.1 does not address requirements for mastics.

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

Retain subparagraph below if low-emitting materials are required. Consult mastic manufacturers to determine VOC limits.

- 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

Verify that products listed comply with water-vapor permeance. Require proof of performance and certified test reports from vapor-barrier mastic manufacturer to support product literature claims.

Retain one of four mastic paragraphs below. Product attributes in first paragraph are based on Foster; there are variations among manufacturers.

- B. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Childers Brand; H. B. Fuller Construction Products; CP-10.
  - b. Eagle Bridges - Marathon Industries.
  - c. Foster Brand; H. B. Fuller Construction Products; 46-50.
  - d. Knauf Insulation; EXPERT Mastics - KI-700 ASJ.
  - e. Mon-Eco Industries, Inc; 55-50.
  - f. Vimasco Corporation; WC-1/WC-5.
2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F .
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

## 2.4 SECUREMENTS

- A. Bands:

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. ITW Insulation Systems; Illinois Tool Works, Inc; Gerrard Strapping and Seals.
  - b. RPR Products, Inc; Insul-Mate Strapping, Seals, and Springs.

Wing seals are primarily used for fastening bands together. Closed seals are occasionally used for large, 84-inch- (2130-mm-) diameter applications and where fastening bands are used with springs. Wing seals are reusable; closed seals are not.

2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch thick, 1/2 inch wide with wing seal.
3. Aluminum: ASTM B 209 , Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal.

Springs are used for large, 84-inch- (2130-mm-) diameter applications and on applications with rapid changes in expansion and contraction.

4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

- a. Products: Subject to compliance with requirements, provide one of the following:

- 1) AGM Industries, Inc; CWP-1.
- 2) Gemco; CD.
- 3) Hardcast, Inc.
- 4) Midwest Fasteners, Inc; CD.
- 5) Nelson Stud Welding; TPA, TPC, and TPS.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

- a. Products: Subject to compliance with requirements, provide one of the following:

- 1) AGM Industries, Inc; CHP-1.
- 2) CL WARD & Family Inc; CL WARD Weld Pins.
- 3) Gemco; Cupped Head Weld Pin.
- 4) Hardcast, Inc.
- 5) Midwest Fasteners, Inc; Cupped Head.
- 6) Nelson Stud Welding; CHP.

3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

- a. Products: Subject to compliance with requirements, provide one of the following:

- 1) [AGM Industries, Inc](#); Tactoo Perforated Base Insul-Hangers.
  - 2) [Gemco](#); Perforated Base.
  - 3) [Midwest Fasteners, Inc](#); Spindle.
- b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  - c. Spindle: Stainless steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
  - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

- a. [Products](#): Subject to compliance with requirements, provide one of the following:
    - 1) [Gemco](#); Nylon Hangers.
    - 2) [Midwest Fasteners, Inc](#); Nylon Insulation Hangers.
  - b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
  - c. Spindle: Nylon, 0.106-inch-diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches .
  - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

- a. [Products](#): Subject to compliance with requirements, provide one of the following:
  - 1) [AGM Industries, Inc](#); Tactoo Self-Adhering Insul-Hangers.
  - 2) [Gemco](#); Peel & Press.
  - 3) [Hardcast, Inc](#).
  - 4) [Midwest Fasteners, Inc](#); Self Stick.



- b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  - c. Spindle: Aluminum, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
  - d. Adhesive-backed base with a peel-off protective cover.
6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, aluminum sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

- a. **Products:** Subject to compliance with requirements, provide one of the following:
    - 1) AGM Industries, Inc; RC-150.
    - 2) Gemco; R-150.
    - 3) Hardcast, Inc.
    - 4) Midwest Fasteners, Inc; WA-150.
    - 5) Nelson Stud Welding; Speed Clips.
  - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

- a. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
    - 1) Gemco.
    - 2) Midwest Fasteners, Inc.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.

In paragraph below, stainless steel is the most common wire used and is best suited for all applications.

- D. Wire: 0.062-inch soft-annealed, stainless steel.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."

- 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:

a. C & F Wire.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  - 1. Verify that systems to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
  1. Draw jacket tight and smooth.
  2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
    - a. For below ambient services, apply vapor-barrier mastic over staples.
  4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

### 3.4 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

In first subparagraph below, many manufacturers do not recommend 100 percent coverage of adhesive because of the effect on the overall insulation system's fire-performance characteristics. Verify application coverage recommendations with insulation manufacturer.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.

Revise first subparagraph below to allow adhesive to be omitted from top surface of horizontal rectangular ducts.

2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
  - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
  - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
  - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
  - d. Do not overcompress insulation during installation.
  - e. Impale insulation over pins and attach speed washers.
  - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
  - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
  - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

### 3.5 FINISHES

Coordinate first paragraph below with Section 099113 "Exterior Painting" and Section 099123 "Interior Painting." If PVC jackets are specified, consult jacket manufacturers to determine suitable paint products and revise painting Sections to suit Project.

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

Retain paint system in subparagraphs below for a flat, latex-emulsion size over insulation covering an exterior that is subject to normal use and moderate environments.

- 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
  - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

Materials and thicknesses in schedules below are for single-layer applications. If multilayer applications are needed, insert additional requirements.

### 3.6 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
  - 1. Indoor, concealed supply and outdoor air.
- B. Items Not Insulated:
  - 1. Fibrous-glass ducts.
  - 2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
  - 3. Factory-insulated flexible ducts.
  - 4. Factory-insulated plenums and casings.
  - 5. Flexible connectors.
  - 6. Vibration-control devices.
  - 7. Factory-insulated access panels and doors.

Duct and plenum insulation schedules in first two articles below specify commonly used insulation materials and thicknesses for each service type. LEED Prerequisite EA 2 requires that duct insulation R-value comply with ASHRAE/IESNA 90.1 tables titled "Minimum Duct Insulation R-Value, Cooling and Heating Only Supply Ducts and Return Ducts" and "Minimum Duct Insulation R-Value, Combined Heating and Cooling Supply Ducts and Return Ducts." Not all materials and thicknesses may be suitable for a specific project. Revise to suit Project after considering all parameters that impact selection. Do not duplicate requirements inserted in "Insulation Materials" Article. See Evaluations for more information and guidance.

Flexible elastomeric and polyolefin thicknesses are limited to 1 inch (25 mm) to meet a flame-spread index of 25 and a smoke-developed index of 50. Condensation control and energy efficiency are limited by thickness.

Consider the exposure of installed insulation to damage. Concealed applications have less risk than exposed.

### 3.7 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

See the Insulation Evaluation tables in the Evaluations for rankings of different insulation types for different service ranges.

Retain "one of" option in paragraphs below to allow Contractor to select piping materials from those retained.

- A. Concealed, round and flat-oval, supply-air duct insulation shall be the following:

Retain one or more of four subparagraphs below.

- 1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density.

END OF SECTION 230713

THIS PAGE IS INTENTIONALLY LEFT BLANK

Copyright 2011 by The American Institute of Architects (AIA)

Exclusively published and distributed by Architectural Computer Services, Inc. (ARCOM) for the AIA

## SECTION 233113 - METAL DUCTS

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term "Architect." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Single-wall round ducts and fittings.
  - 2. Sheet metal materials.
  - 3. Duct liner.
  - 4. Sealants and gaskets.
  - 5. Hangers and supports.
- B. Related Sections:

Retain Sections in subparagraphs below that contain requirements Contractor might expect to find in this Section but are specified in other Sections.

- 1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
- 2. Section 233116 "Nonmetal Ducts" for fibrous-glass ducts, thermoset fiber-reinforced plastic ducts, thermoplastic ducts, PVC ducts, and concrete ducts.
- 3. Section 233119 "HVAC Casings" for factory- and field-fabricated casings for mechanical equipment.



4. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

### 1.3 PERFORMANCE REQUIREMENTS

Retain first paragraph below if Contractor is required to assume responsibility for duct construction design.

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

Retain seismic options and design criteria in first paragraph below that are approved by authorities having jurisdiction.

- B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" ASCE/SEI 7.

Retain paragraph below to comply with LEED Prerequisite IEQ 1.

- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:
  1. Liners and adhesives.
  2. Sealants and gaskets.

### 1.5 QUALITY ASSURANCE

Retain first two paragraphs below if applying for LEED certification or if requiring compliance with ASHRAE or ASHRAE/IESNA.

LEED Prerequisite IEQ 1 requires compliance with requirements in ASHRAE 62.1.

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

## PART 2 - PRODUCTS

### 2.1 SINGLE-WALL ROUND DUCTS AND FITTINGS

See "Static-Pressure Classes" and "Leakage and Seal Classes" articles in the Evaluations for discussion on fabrication.

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

Retain subparagraph below to require factory-fabricated, single-wall round and flat-oval ducts and fittings; delete to allow shop-fabricated ducts and fittings.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers. Retain subparagraph and list of manufacturers below. See Section 016000 "Product Requirements."

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. Ductmate Industries, Inc; GreenSeam Fittings.
  - b. Elgen Manufacturing; Adjustable Elbow.
  - c. Linx Industries (formerly Lindab).
  - d. McGill AirFlow LLC.
  - e. MKT Metal Manufacturing.
  - f. SEMCO LLC; SEMCO Single-Wall Round Duct & Fittings.
  - g. Sheet Metal Connectors, Inc.
  - h. Spiral Manufacturing Co., Inc.
  - i. Stamped Fittings Inc; "The EDGE" self sealing spiral duct system.
- B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).
- C. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- E. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing

requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## 2.2 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

See "Sheet Metal Materials" Article in the Evaluations for discussion on applicable materials and coatings in first six paragraphs below.

- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G60 .
  - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
  - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches .

## 2.3 DUCT LINER

If the objective of duct liner includes achievement of both thermal performance and sound absorption, then ducts may need additional external insulation to achieve the thermal portion of the objective. See Section 230713 "Duct Insulation" for applicable duct insulation and installation requirements for external duct application.

LEED Prerequisite EA 2 requires that duct insulation R-value comply with ASHRAE/IESNA 90.1 tables titled "Minimum Duct Insulation R-Value, Cooling and Heating Only Supply Ducts and Return Ducts" and "Minimum Duct Insulation R-Value, Combined Heating and Cooling Supply Ducts and Return Ducts." If using liner alone to satisfy thermal requirements, verify that material selected is available in thickness needed to provide thermal performance without jeopardizing other requirements.

Type I duct liner is available in thicknesses of 1/2 to 2 inches (13 to 50 mm) in 1/2-inch (13-mm) increments; Type II duct liner is available in thicknesses of 1 to 2 inches (25 to 50 mm) in 1/2-inch (13-mm) increments. Indicate thicknesses on Drawings or in the "Duct Schedule" Article.

When specifying duct liner by referencing ASTM C 1071, specifiers are assured of product qualifications for corrosiveness, water-vapor sorption, fungi resistance, temperature resistance,

erosion resistance, odor emission, surface-burning characteristics, apparent thermal conductivity, sound absorption coefficients, bacteria resistance, and combustion characteristics.

- A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers. Retain one of first two subparagraphs and list of manufacturers below. See Section 016000 "Product Requirements."

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:

To exceed the minimum requirements set by ASTM C 1071, verify that a particular manufacturer's product can meet the requirements, retain the "Basis-of-Design Product" Subparagraph below, and insert the manufacturer's name and product designation.

2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. CertainTeed Corporation.
  - b. Johns Manville; a Berkshire Hathaway company.
  - c. Knauf Insulation; Atmosphere Duct Liner with ECOSE Technology.
  - d. Owens Corning.
3. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

Flexible elastomeric duct liner in first paragraph below is not suitable for temperatures higher than 220 deg F (104 deg C).

- B. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers. Retain one of first two subparagraphs and list of manufacturers below. See Section 016000 "Product Requirements."

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:

To exceed the minimum requirements set by ASTM C 1071, verify that a particular manufacturer's product can meet the requirements, retain the "Basis-of-Design Product" Subparagraph below, and insert the manufacturer's name and product designation.

2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. Aeroflex USA, Inc.
  - b. Armacell LLC.
  - c. K-Flex USA; K-FLEX Duct Liner Gray.

d. Rubatex International, LLC.

Available thicknesses for flexible elastomeric duct liner are 3/8, 1/2, 3/4, and 1 inch (10, 13, 19, and 25 mm). Indicate thickness on Drawings or in the "Duct Schedule" Article.

Surface-burning characteristics in first subparagraph below are available in limited thicknesses. Verify maximum thickness with manufacturers.

3. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
4. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

C. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, **[0.106-inch-][0.135-inch-]**diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

D. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.

Delete first subparagraph below if air velocities do not exceed 2500 fpm (12.7 m/s).

4. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm .

Securing method in first subparagraph below is for ducts with air velocities of 2500 fpm (12.7 m/s) and lower. Use caution when designing lined ducts with air velocities higher than 2500 fpm (12.7 m/s). See SMACNA for requirements.

5. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
6. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
  - a. Fan discharges.
  - b. Intervals of lined duct preceding unlined duct.

- c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

Retain first subparagraph below if ducts with air velocities higher than 4000 fpm (20.3 m/s) are anticipated; indicate locations of double-wall ducts on Drawings. Use solid-metal (unperforated) inner ducts for material-handling exhaust systems.

- 7. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
  - a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.
- 8. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

## 2.4 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

Retain one of first two paragraphs below. If retaining second paragraph, verify acceptability with authorities having jurisdiction.

- B. Water-Based Joint and Seam Sealant:

- 1. Application Method: Brush on.
- 2. Solids Content: Minimum 65 percent.
- 3. Shore A Hardness: Minimum 20.
- 4. Water resistant.
- 5. Mold and mildew resistant.
- 6. VOC: Maximum 75 g/L (less water).
- 7. Maximum Static-Pressure Class: 10-inch wg , positive and negative.
- 8. Service: Indoor or outdoor.
- 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

- C. Flanged Joint Sealant: Comply with ASTM C 920.

- 1. General: Single-component, acid-curing, silicone, elastomeric.
- 2. Type: S.
- 3. Grade: NS.
- 4. Class: 25.
- 5. Use: O.

- D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

## 2.5 HANGERS AND SUPPORTS

Indicate the extent of corrosive environment on Drawings.

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- D. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- E. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- G. Trapeze and Riser Supports:
  - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
  - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
  - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

## PART 3 - EXECUTION

### 3.1 DUCT INSTALLATION

Coordinate duct layout and duct accessory arrangement with Drawings.

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch , plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches .
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

### 3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

### 3.3 DUCT SEALING

Retain one of two paragraphs below. Retain first paragraph if retaining subparagraphs for seal class and leakage class in "Duct Schedule" Article; otherwise, delete first and retain second paragraph.

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."



### 3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

Verify attachment selection and spacing in first two paragraphs below with structural engineer.

- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
  - 1. Where practical, install concrete inserts before placing concrete.
  - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
  - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
  - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- C. Hangers Exposed to View: Threaded rod and angle or channel supports.
- D. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet .
- E. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

### 3.5 CONNECTIONS

Coordinate duct installations and specialty arrangements with Drawings.

- A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

### 3.6 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

### 3.7 DUCT SCHEDULE

- A. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

B. Liner:

LEED Prerequisite EA 2 requires that duct insulation R-value comply with ASHRAE/IESNA 90.1 tables titled "Minimum Duct Insulation R-Value, Cooling and Heating Only Supply Ducts and Return Ducts" and "Minimum Duct Insulation R-Value, Combined Heating and Cooling Supply Ducts and Return Ducts." If using liner alone to satisfy thermal requirements, verify that material selected is available in thickness needed to provide thermal performance without jeopardizing other requirements.

Flexible elastomeric insulation is available in thicknesses through 1-1/2 inches (38 mm), which comply with NFPA 90A. Some options in subparagraphs below may create a restrictive proprietary specification. Verify availability of performance with manufacturers.

Retain one option for material and one option for thickness, or insert another thickness, in each of six subparagraphs below.

1. Supply Air Ducts: Flexible elastomeric, 1 inch thick.
2. Return Air Ducts: Flexible elastomeric, 1 inch thick.
3. Exhaust Air Ducts: Flexible elastomeric, 1 inch thick.
4. Supply Fan Plenums: Flexible elastomeric, 1 inch thick.
5. Return- and Exhaust-Fan Plenums: Flexible elastomeric, 1 inch thick.
6. Transfer Ducts: Flexible elastomeric, 1 inch thick.

C. Elbow Configuration:

1. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
  - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

Retain first three subparagraphs below, or delete and retain fourth subparagraph.

- 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
- 2) Radius-to Diameter Ratio: 1.5.
- b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
- c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

Delete paragraph below if branch fittings are detailed on Drawings.

D. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

- a. Rectangular Main to Rectangular Branch: 45-degree entry.
  - b. Rectangular Main to Round Branch: Spin in.
2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
- a. Velocity 1000 fpm or Lower: 90-degree tap.
  - b. Velocity 1000 to 1500 fpm : Conical tap.
  - c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

Copyright 2013 by The American Institute of Architects (AIA)

Exclusively published and distributed by Architectural Computer Services, Inc. (ARCOM) for the AIA

## SECTION 233300 - AIR DUCT ACCESSORIES

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term "Architect." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

- 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. Manual volume dampers.
  - 2. Flexible ducts.
  - 3. Duct accessory hardware.

- B. Related Requirements:

Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.

- 1. Section 233723 "HVAC Gravity Ventilators" for roof-mounted ventilator caps.

Retain one of two subparagraphs below.

- 2. Section 283111 "Digital, Addressable Fire-Alarm System" for duct-mounted fire and smoke detectors.
- 3. Section 283112 "Zoned (DC-Loop) Fire-Alarm System" for duct-mounted fire and smoke detectors.

### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. For duct silencers, include pressure drop and dynamic insertion loss data. Include breakout noise calculations for high transmission loss casings.

### 1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

## PART 2 - PRODUCTS

See Editing Instruction No. 1 in the Evaluations for cautions about named manufacturers and products. For an explanation of options and Contractor's product selection procedures, see Section 016000 "Product Requirements."

### 2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

### 2.2 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G60 .
  - 2. Exposed-Surface Finish: Mill phosphatized.
- B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and galvanized finish for exposed ducts.
- C. Aluminum Sheets: Comply with ASTM B 209 , Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- D. Extruded Aluminum: Comply with ASTM B 221 , Alloy 6063, Temper T6.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches .

## 2.3 MANUAL VOLUME DAMPERS

Show dampers on Drawings. If both standard and low-leakage volume dampers are required, identify each damper type on Drawings.

### A. Standard, Steel, Manual Volume Dampers:

Retain "Manufacturers" Subparagraph and list of manufacturers below to require products from manufacturers listed or a comparable product from other manufacturers.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Retain "Basis-of-Design Product" Subparagraph and list of manufacturers below to identify a specific product or a comparable product from manufacturers listed. Retain option and delete insert note if manufacturer's name and model number are indicated on Drawings.

2. Basis-of-Design Product ct to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. Aire Technologies; Series 80.
  - b. American Warming and Ventilating; a Mestek Architectural Group company.
  - c. Flex-Tek Group.
  - d. McGill AirFlow LLC.
  - e. Ruskin Company.
3. Standard leakage rating, with linkage outside airstream.
4. Suitable for horizontal or vertical applications.
5. Frames:
  - a. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel.
  - b. Mitered and welded corners.
  - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
6. Blades:
  - a. Multiple or single blade.
  - b. Parallel- or opposed-blade design.
  - c. Stiffen damper blades for stability.
  - d. Galvanized-steel, 0.064 inch thick.
7. Blade Axles: Galvanized steel.
8. Bearings:
  - a. Oil-impregnated bronze.
  - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
9. Tie Bars and Brackets: Galvanized steel.

B. Jackshaft:

1. Size: 0.5-inch diameter.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

C. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

## 2.4 FLEXIBLE DUCTS

UL 181 defines two categories of flexible ducts. Ducts listed according to UL 181 must pass all UL 181 tests. Air connectors listed according to UL 181 must pass most, but not all, UL 181 tests and are limited to lengths of 14 feet (4.3 m) or less.

Retain "Manufacturers" Paragraph and list of manufacturers below to require products from manufacturers listed or a comparable product from other 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:

Retain one of five "Noninsulated, Flexible Duct" paragraphs below.

Retain one of five "Insulated, Flexible Duct" paragraphs.

- B. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm .
3. Temperature Range: Minus 10 to plus 160 deg F .

LEED Prerequisite EA 2 requires that duct insulation R-value comply with ASHRAE/IESNA 90.1-2004 tables titled "Minimum Duct Insulation R-Value, Cooling and Heating Only Supply Ducts and Return Ducts" and "Minimum Duct Insulation R-Value, Combined Heating and Cooling Supply Ducts and Return Ducts."

4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

- C. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.

1. Pressure Rating: 4-inch wg positive and 0.5-inch wg negative.
2. Maximum Air Velocity: 4000 fpm .

3. Temperature Range: Minus 20 to plus 175 deg F .

LEED Prerequisite EA 2 requires that duct insulation R-value comply with ASHRAE/IESNA 90.1-2004 tables titled "Minimum Duct Insulation R-Value, Cooling and Heating Only Supply Ducts and Return Ducts" and "Minimum Duct Insulation R-Value, Combined Heating and Cooling Supply Ducts and Return Ducts."

4. Insulation R-Value: Comply with ASHRAE/IESNA 90.1.

D. Flexible Duct Connectors:

1. Clamps: Nylon strap in sizes 3 through 18 inches , to suit duct size.

## 2.5 DUCT ACCESSORY HARDWARE

- A. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

To minimize duct noise generated by volume dampers, SMACNA recommends locating dampers at least two duct diameters from fittings and as far away as possible from outlets.

- C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

Coordinate subparagraphs below with Section 233113 "Metal Ducts."

1. Install steel volume dampers in steel ducts.
  2. Install aluminum volume dampers in aluminum ducts.
- D. Set dampers to fully open position before testing, adjusting, and balancing.
  - E. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

Retain first paragraph below to allow use of flexible duct to connect terminal units to metal duct.

- F. Connect terminal units to supply ducts directly or with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.



- G. Connect flexible ducts to metal ducts with draw bands.

END OF SECTION 233300

Copyright 2011 by The American Institute of Architects (AIA)

Exclusively published and distributed by Architectural Computer Services, Inc. (ARCOM) for the AIA

## SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

Revise this Section by deleting and inserting text to meet Project-specific requirements.

This Section uses the term "Architect." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

- 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. Rectangular and square ceiling diffusers.
- B. Related Sections:

Retain Sections in subparagraphs below that contain requirements Contractor might expect to find in this Section but are specified in other Sections.

- 1. Section 089116 "Operable Wall Louvers" and Section 089119 "Fixed Louvers" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
- 2. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

## PART 2 - PRODUCTS

### 2.1 CEILING DIFFUSERS

Copy paragraphs below and re-edit for each product.

#### A. Rectangular and Square Ceiling Diffusers 1:

See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers. Retain one of first two subparagraphs and list of manufacturers below. See Section 016000 "Product Requirements."

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. Material: Steel.
3. Finish: Baked enamel, white.
4. Face Size: 24 by 24 inches .
5. Face Style: Three cone.
6. Mounting: T-bar.
7. Pattern: Fixed.
8. Dampers: Butterfly.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure

drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

### 3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

**DIVISION 26 - ELECTRICAL**

Division	Section Title	Pages
260100.....	GENERAL REQUIREMENTS FOR ELECTRICAL WORK.....	11
260519.....	LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.....	4
260526.....	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.....	7
260529.....	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS.....	5
260533.....	RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS.....	10
260553.....	IDENTIFICATION FOR ELECTRICAL SYSTEMS.....	6
262416.....	PANELBOARDS.....	9
262726.....	WIRING DEVICES.....	8
265116.....	INTERIOR LIGHTING.....	6

By: Richard W. Wiley, PE., #104241  
Campos Engineering, Inc.  
Registration No. F-001731  
1331 River Bend Drive  
Dallas, Tx 75247  
Ph: 214-696-6291



THIS PAGE IS INTENTIONALLY LEFT BLANK

## SECTION 26 01 00 – GENERAL REQUIREMENTS FOR ELECTRICAL WORK

### PART 1 – GENERAL

#### 1.1 DESCRIPTION

- A. General Requirements for Electrical Work are intended to be complementary to General Requirements of Construction Contract.
- B. Work Included: Provide and install complete electrical items where shown on Drawings, as specified herein, and as needed for complete and proper installation including, but not limited to the following summary of Work:
  - 1. A complete electrical system including power, lighting, medium and low voltage systems.
  - 2. A complete system of feeders and branch circuits to supply electrical power for the entire facility.
  - 3. All Interior luminaries and lamps.
  - 4. All exterior luminaries, lamps, conduit and wiring including all those shown or otherwise implied in the architectural, lighting and landscape drawings.
  - 5. Emergency egress luminaries.
  - 6. Interior and exterior lighting control.
  - 7. Wiring devices, outlets, disconnect switches, coverplates, etc.
  - 8. Main electrical service.
  - 9. Pad-mount transformer.
  - 10. A complete electrical distribution system including switchgear, switchboards, panelboards, transformers, disconnects, etc.
  - 11. Hangers, anchors, sleeves, chases, supports for fixtures, and other electrical materials and associated equipment.
  - 12. Motor starters and controls for motors provided under the Contract, but for which motor starters and controls are not otherwise provided.
  - 13. Provisions for low voltage systems.
  - 14. A complete fire alarm system as indicated.
  - 15. A complete short circuit, breaker coordination and arc flash study.
  - 16. A complete lightning protection system.
  - 17. Other items and services as required for a complete electrical system.
  - 18. Surge protection.
  - 19. All work specified as addenda in drawings or missives by the architect, engineer, or MSU.

#### 1.2 QUALITY ASSURANCE AND APPLICABLE STANDARDS

- A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of the Work of this Section.
- B. Without additional cost to the Engineer/Owner, provide such other labor and materials as are required to complete the Work of this Section in accordance with the requirements of Governmental Agencies having jurisdiction, regardless of whether materials and associated labor are delineated elsewhere in these Contract Documents.
- C. When requested, provide the Owner's Authorized Representative with manufacturer's certificate that materials meet or exceed minimum requirements as specified.
- D. Electrical and Fire Alarm Work shall conform to requirements and recommendations of the latest edition of the National Electrical Code and local codes and ordinances. When codes conflict, the more stringent requirements shall govern.

- E. Specifications and Standards of the following organizations are by reference made part of these Specifications. Electrical Work, unless otherwise indicated, shall comply with requirements and recommendations wherever applicable:

1. Association of Edison Illuminating Companies (AEIC)
2. American National Standards Institute (ANSI)
3. American Society for Testing and Materials (ASTM)
4. Certified Ballast Manufacturers (CBM)
5. Electrical Testing Laboratories (ETL)
6. Institute of Electrical and Electronic Engineers (IEEE)
7. Insulated Power Cable Engineers Association (IPCEA)
8. National Bureau of Standards (NBS)
9. National Electrical Contractors Association (NECA)
10. National Electrical Manufacturer's Association (NEMA)
11. National Fire Protection Association (NFPA)
12. Radio-Television Manufacturer's Association (RTMA)
13. Reflector Luminaire Manufacturers (RLM)
14. Underwriters' Laboratories, Inc. (UL)
15. National Electrical Testing Association (NETA)

### 1.3 REQUIREMENTS OF REGULATORY AGENCIES

- A. Requirements and recommendations of the latest editions of the Occupational Safety and Health Act (OSHA), Americans with Disabilities Act (ADA), and the Texas Accessibility Standards (TAS) are by reference made part of these Specifications. Work shall comply with requirements and recommendations wherever applicable.

### 1.4 RELATED WORK SPECIFIED ELSEWHERE

- A. Other Sections of Divisions 23, 26, 27, and 28.
- B. Other Divisions of Contract Documents. Refer to each Division's Specifications and Drawings for requirements.
- C. Contract Documents and Specifications for Bid Package 1, "New Residence Housing."

### 1.5 SUBMITTALS

- A. Comply with pertinent provisions of Division 01.
- B. Submittals required of materials and equipment include following:
1. Materials list of items proposed to be provided under Division 26, 27 and 28.
  2. Manufacturer's specifications and other data needed to prove compliance with specified requirements. The term "Compliance" shall mean that the Contractor certifies that submitted equipment meets or exceeds Contract Document requirements. Items that do not clearly meet this definition should be identified and explained as required in the following paragraph.
  3. Explain with enough detail so that it can easily be determined that the item complies with the functional intent. List disadvantages or advantages of proposed item versus specified item. Submit technical data sheets and pictures and diagrams to support and clarify. Organize in a clear and concise format. Substitutions must be approved in writing by the Engineer. The Engineer's decision shall be final.
  4. Allow a minimum of ten (10) working days for review of each submittal and resubmittal.
  5. Items of equipment that are not accepted in writing as "approved equal" shall be replaced or revised to comply with the Contract Documents at the Contractor's expense.



6. The manufacturer's recommended installation procedures shall become the basis for accepting or rejecting actual installation procedures used on the Work.
  7. Shop drawings shall consist of detailed drawings with dimensions, schedules, weights, capacities, installation details and pertinent information needed to describe the material or equipment.
- C. Submittals required of materials and equipment under this Division includes the following listed items not supplied by the Owner. These submittal requirements are intended to be complimentary to the requirements that may be listed in the individual sections. In the event of conflict, more stringent requirement shall apply.
1. Conductors and Cabling
    - a. Submit product data for each specified product.
  2. Raceways and Boxes
    - a. Submit product data for surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
    - b. Submit Shop Drawings including layout drawings showing components and wiring for nonstandard boxes, enclosures, and cabinets.
  3. Wiring Devices
    - a. Product Data: For each product type indicated.
    - b. Submit operation and maintenance data for wiring devices, for inclusion in "Operating and Maintenance Manual" specified in this section.
  4. Hangers and Supports
    - a. Product Data: For the following:
      1. Steel slotted support systems.
    - b. Shop Drawings Show fabrication and installation details and include calculations for the following:
      1. Trapeze hangers. Include Product Data for components.
      2. Steel slotted channel systems. Include Product Data for components.
      3. Equipment supports.
  5. Conductors and Cables for Electronic Safety and Security
    - a. Submit product data for each product and component specified.
  6. Electrical Identification
    - a. Submit product data for each product and component specified.
  7. Mechanical Equipment and Controls
    - a. Submit product data for each product and component specified.
  8. Grounding and Bonding

- a. Submit product data for grounding rods, connectors and connection materials, and grounding fittings.
9. Interior and Exterior Lighting
- a. Submit product data describing fixtures, lamps, ballasts, and emergency lighting units. Arrange product data for fixtures in order of fixture designation. Include data on features and accessories.
  - b. Submit outline drawings indicating dimensions and principal features of fixtures.
  - c. Submit electrical ratings and photometric data including certified results of laboratory tests for fixtures and lamps.
  - d. Submit battery and charger data for emergency lighting units.
  - e. Submit Shop Drawings detailing nonstandard fixtures and indicating dimensions, weights, and methods of field assembly, components, features, and accessories.
  - f. Submit wiring diagrams detailing wiring for control system showing both factory-installed and field-installed wiring for each specific system which differentiates between factory-installed and field-installed wiring.
  - g. Submit air and thermal performance data for air-handling fixtures.
  - h. Submit sound performance data for air-handling fixtures.
  - i. Submit maintenance data for fixtures to include in the Operation and Maintenance Manual as specified in this Section.
10. Digital Addressable Fire Alarm System
- a. The fire alarm system drawings will not be reviewed by the Engineer until the system has been reviewed and approved by the local code authority having jurisdiction.
  - b. Product Data: Submit four (4) complete sets of documentation. Document the type, size, rating, style, catalog number, manufacturer name, photographs, and catalog data sheets for items proposed to meet these specifications. The proposed equipment shall be subject to approval of the Engineer, and no equipment shall be ordered or installed without that approval.
  - c. Shop Drawings: Submit complete set of Shop Drawings, one for each unit sub-assembly that requires that field wire be connected to it. Shop Drawings shall be reproduced electronically from a Master Copy supplied by the manufacturer in digital format.
    1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
    2. Shop Drawings shall be prepared by persons with the following qualifications:
      - a. Trained and certified by manufacturer in fire-alarm system design.
      - b. NICET-certified fire-alarm technician, Level III minimum.
    3. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
    4. Record copy of site-specific software.
    5. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
      6. Frequency of testing of installed components.
      7. Frequency of inspection of installed components.
      8. Requirements and recommendations related to results of maintenance.
      9. Manufacturer's user training manuals.

10. Include voltage drop calculations for notification appliance circuits. Size circuits to provide 20% spare capacity.
  11. Include battery-size calculations.
  12. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
  13. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
  14. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.
  15. Include on drawings candela ratings of all strobe units
- d. Close-out Submittals: Eight (8) copies of following Manual shall be delivered to the Engineer at the time of system acceptance. Close out submittals shall include:
1. Operating manuals covering installed Life Safety System.
  2. Point-to-point diagrams of the entire Life Safety System as installed. This shall include connected smoke detectors and addressable field modules. Drawings shall be provided in standard DXF format. Also provide vellum plots of each sheet. System-generated point-to-point diagrams are required to ensure accuracy.
  3. An application program listing for the system as installed at the time of acceptance.
  4. Name, address, and telephone number of the authorized factory representative.
  5. Drawings must reflect the device address and programmed characteristics as verified in presence of the Engineer and the Owner's Authorized Representative.
  6. "As-Built" riser and wiring diagrams reflecting T-taps and each programmed device characteristic including detector type, base type, address, sensitivity setting, and wire configurations shall be provided to the Engineer.
11. Record Documents. Refer to the "Project Record Documents" paragraph of this Section.
12. Operation and Maintenance Data. Refer to the "Operation and Maintenance Data" paragraph of this Section.
- D. Resubmittals of rejected submittals shall be limited to one (1) in number. Costs for processing subsequent resubmittals in excess of the first resubmittal, resulting from the Contractor's disregard of the Architect/Engineer's primary submittal rejection comments, shall be borne by the Contractor. Costs shall be based on the Architect/Engineer's hourly rates as published in their current professional fee schedules and shall also include reimbursable costs for delivery, mailing, and photocopies at direct cost plus ten percent (10%).

## 1.6 SUBSTITUTIONS

- A. The Contract Documents list manufacturers' names and catalog numbers followed by the phrase "or equal" are to establish a standard of quality and utility for the specified items and to provide a dimensional reference to the scaled drawings.
- B. Submittals for "equal" items shall include the following data, which is not necessarily required for specified items which list the manufacturer and catalog number:
1. Performance characteristics.
  2. Materials.

3. Finish.
  4. Certification of conformance with specified codes and standards.
  5. Manufacturer's specifications and other data needed to prove compliance with the specified requirements. The term "compliance" is understood to mean that the submitted equipment will meet or exceed the Contract Document requirements. Items that do not clearly meet this definition shall be identified and explained as required in the following Paragraph.
  6. Identify the difference between specified equipment and proposed substituted equipment. Explain with enough detail so that the Engineer/Owner can easily determine that the item complies with the functional intent. List disadvantages or advantages of the proposed item versus the specified item. Submit technical data sheets and pictures and diagrams to support and clarify. Organize in a clear and concise format. The Engineer shall approve substitutions in writing. The Engineer's decision shall be final.
- C. Submittals of "equal" components or systems may be rejected if:
1. The material or equipment would necessitate alteration of the mechanical, electrical, architectural, or structural design.
  2. Dimensions vary from specified material or equipment so that accessibility or clearances are impaired or Work of other trades is adversely affected.
- D. Proposed substitutions for materials or equipment must be submitted ten (10) days prior to final bid date for consideration as approved equals. Otherwise, substitutions will not be permitted. Only prime bidders shall make proposals for substitutions.
- E. No substitution shall be made unless authorized in writing by the Engineer. Should substitution be accepted, and should substitute material prove defective or otherwise unsatisfactory for service intended, and within guarantee period, replace this material or equipment with material or equipment specified, to the satisfaction of the Engineer and at no cost to the Engineer/Owner.

#### 1.7 ORDINANCES, PERMITS, METERS, UTILITIES AND ROYALTIES

- A. Purchase all necessary permits and licenses necessary for completion of the Work. Pay all lawful fees required and necessary pursuant in obtaining said permits and licenses. Certificates of approvals and inspections by local governing and regulating authorities are required.
- B. Pay all fees required for the connection of utility power and telephone services required for the Work.
- C. Pay royalty payments or fees required for the use of patented equipment or systems. Defend lawsuits or claims for infringement of the patent rights and hold the Engineer/Owner harmless from loss as result of said suits or claims.

#### 1.8 COMPATIBILITY OF EQUIPMENT

- A. Assume full responsibility for the satisfactory operation of component parts of the electrical systems. Assure compatibility of equipment and performance of the integrated systems in accordance with the requirements of the Construction Documents. Notify the Engineer before submitting a bid should the Specifications or Drawings make acceptance of responsibility impossible, prohibitive, or restrictive. The bid shall be accompanied by a written statement listing any objections or exceptions to the applicable specification section and drawing.

#### 1.9 UTILITIES AND TEMPORARY POWER

- A. Verify the location and capacity of all existing utility services before starting the Work. The locations and sizes of electrical lines are shown in accordance with data secured from the Owner's survey. The data shown is offered as an estimating guide without guarantee of accuracy.

- B. Pay all utility charges for temporary power not paid by the Owner. Provide all temporary lighting and power required. Install in accordance with OSHA requirements and as described in the General Requirements, Division 1.

#### 1.10 FLASHINGS, SLEEVES, AND INSERTS

- A. Provide flashings where conduits pass through outside walls. Flashings shall be properly formed to fit around conduit and shall be caulked, with 790 Silicone Building Sealant by the Dow Corning Corporation, so as to make a watertight seal between conduit and building.
- B. Unless otherwise specified, install sleeves for each conduit where it may pass through interior walls or floors. Galvanized 22 gage sheet iron sleeves shall be used. Finish flush with each finished wall surface. In pipe chases, the sleeve shall extend 1-1/2 inches above the floor slab and shall be watertight.
- C. Raceways that pass through concrete beams or walls and masonry exterior walls shall be provided with galvanized wrought iron pipe sleeves, unless shown otherwise on drawings. Inside diameter of these sleeves shall be at least 1/2 inch greater than outside diameters of service pipes. After pipes are installed in these sleeves, fill annular space between the pipes and sleeves with 790 Silicone Building Sealant by the Dow Corning Corporation. Completed installation shall be watertight.
- D. Roof penetrations shall be provided with counter flashings arranged to provide weatherproof installation.
- E. Penetrations through walls, floors, and ceilings shall be done in manner to maintain integrity of fire rating of the respective wall, floor, or ceiling.
- F. Reference Division 1 for additional sealant requirements. Where conflicts occur with the specified requirements, the more stringent shall apply.

#### 1.11 SURFACE CONDITIONS

- A. Examine the areas and conditions under which the Work of this Division will be performed. Work required to correct conditions detrimental to timely and proper completion of Work shall be included as part of the Work of this Division. Do not proceed until unsatisfactory conditions are corrected.

#### 1.12 CONSTRUCTION REQUIREMENTS

- A. The drawings show arrangements of the Work. Rearrangement of the spaces and equipment will be considered when the Project conditions make this necessary and materials or equipment can be installed to better advantage. Prior to proceeding with the Work, coordinate with the various trades to prepare and submit five (5) copies of Drawings of the proposed arrangement for the Engineer's review. Allow a minimum of ten (10) working days for review.
- B. Installation or rearrangement of the equipment and space for the Contractor's convenience or to accommodate the material or equipment substitutions will be considered. Assume responsibility for rearrangement of equipment and space and have the Engineer review change before proceeding with the Work. Request for changes shall be accompanied by Shop Drawings of the affected equipment and space. Identify proposed monetary credits or other benefits. Allow a minimum of ten (10) working days for review.
- C. Properly locate and size all required pipe sleeves and slots, holes, or openings in structure.

#### 1.13 PREPARATION AND COORDINATION

- A. Coordinate the work in strict accordance with the Contract Documents as follows:
  - 1. Where lighting fixtures and other electrical items are shown in conflict with locations of structural members and mechanical or other equipment, provide required supports and wiring to clear encroachment. Shop drawings shall be furnished by this section, indicating all changes to meet space requirements, code requirements, and as necessary to resolve all space conflicts.
  - 2. Install power and control wiring for installation of equipment furnished under Division 23. Furnish disconnect switches and other equipment as required for the proper operation of equipment unless equipment is specified to be factory mounted.
- B. Information on the Drawings and in these Specifications is reasonably accurate, but absolute accuracy is not guaranteed. The drawings are diagrammatic, and the exact locations, distances, levels, and other conditions shall be governed by actual construction.
- C. Where receptacles are not specifically located on the Drawings, locate as determined in field by the Engineer. Where convenience receptacles are installed without the Engineer's specific direction, relocate as directed by the Engineer at no additional cost to the Owner.
- D. Field-verify measurements. No extra compensation will be allowed because of differences between the Work shown on Drawings and actual site measurements.
- E. Branch circuit wiring and arrangement of home runs have been designed for maximum economy consistent with adequate sizing and other considerations. Increase size of wiring and wiring systems to accommodate more stringent requirements listed in these Specifications or on the Drawings. Install wiring with circuits arranged as shown on the Drawings, except as otherwise approved in advance by the Engineer.
- F. Equipment Layout:
  - 1. The physical location and arrangements of electrical equipment is shown on the Plans and is to be used by the Electrical Contractor as a guideline in construction. It is the responsibility of the Electrical Contractor to review the Plans with the proposed equipment and equipment of other contractors that are affected, and to insure that all Code required clearances, wiring distances and maintenance accesses, including equipment heights, of all items are maintained.
  - 2. Alternate arrangements to accomplish the above due to field conditions or changes in physical size of the equipment proposed for the project are to be submitted to the Architect for review before any work is begun or equipment ordered.
  - 3. The alternate arrangement is to be presented in a 1/4 inch scaled drawing showing all equipment, including those of other contractors. Include shop drawing cut sheets and applicable information.
  - 4. Indicate on the drawing by dimension all required Code clearances, wiring distances and maintenance access requirements. Where equipment heights are required to be coordinated with architectural or other items, indicate revised heights.

#### 1.14 PROJECT RECORD DOCUMENTS

- A. Provide Project record documents associated with Work in accordance with the provisions of these Specifications. Refer to Division 01 for additional requirements.
- B. Throughout progress of the Work, maintain accurate record of all changes in Contract Documents (Drawings and Specifications). Changes shall include Addendums issued during bidding and location of the electrical service lines, receptacles, and outside utilities.
- C. Delegate responsibility for maintenance of record documents to one person on the Contractor's staff.

D. Accuracy of Records

1. Thoroughly coordinate changes, making adequate and proper entries on each page of the Specifications and each sheet of the Drawings and other documents. Match symbology and format of base documents.
2. Accuracy of records shall be such that future searches for items shown in Contract Documents may rely reasonably on the information obtained from approved Project record documents.

E. Maintain a job set of record documents protected from deterioration and from loss and damage until completion of Work. Transfer all recorded data to the final Project record documents.

F. Making Entries on Drawings

1. Using erasable colored pencil (not ink or indelible pencil), clearly describe the changes by graphic line and note as required.
2. Date entries.
3. Call attention to the entry by "cloud" drawn around area or areas affected.
4. In event of overlapping changes, use different colors for overlapping changes.
5. Make entries within twenty-four (24) hours after receipt of information that changes have occurred.
6. Maintain base drawing format and use same symbology.
7. Convert field mark-ups to finished CADD record drawings when required in this Section.
8. Convert Schematic Layouts to represent the final installed conditions.

G. Final Project Record Documents

1. The purpose of the final Project Record Documents is to provide factual information regarding all aspects of the Work, both concealed and visible, to enable future modification of the Work to proceed without lengthy and expensive site measurement, investigation, and examination.
2. Provide CADD Electronic files in ".dwg" format using AutoCAD Release 2010 software (minimum). Upon written request, completion of the release form, and payment of the Engineer's standard fee of \$250 for set-up charge and \$25 per drawing for copies of such files, the Engineer will provide AutoCAD Release 2010 electronic files of the base Contract Drawings in ".dwg" format on compact disc. The Engineer will also provide a list of the drawing layers and names that shall be maintained.
3. Provide a complete set of record drawings on one compact disc and one reproducible Mylar film of each drawing.

1.15 OPERATION AND MAINTENANCE DATA

- A. Submit two (2) copies of the preliminary draft of the proposed manual or manuals to the Engineer for review and comments. Allow a minimum of ten (10) working days for review.
- B. Submit approved manual to the Engineer prior to the indoctrination of the operation and maintenance personnel.
- C. Where instruction manuals are required for submittal, they shall be prepared in accordance with the following:

Format: Size: 8-1/2-inch by 11-inch

Paper: White bond, at least 20 pound weight

Text: Neatly written or printed

Drawings:	11 inches in height preferable; bind in with text; foldout acceptable; larger drawings acceptable but fold to fit within Manual and provide drawing pocket inside the rear cover or bind in with text.
Flysheets:	Separate each section of the Manual with neatly prepared flysheets briefly describing the contents of ensuing section; flysheets may be in color.
Binding:	Use heavy-duty plastic or fiberboard covers with binding mechanism concealed inside manual; 3-ring binders will be acceptable; binding is subject to the Engineer's approval.
Measurements:	Provide measurements in U.S. standard units (e.g., feet, inches, and pounds). Where items may be expected to be measured within ten (10) years in accordance with the metric formulae, provide additional measurements in "International System of Units" (SI).

Provide front and back covers for each manual, using durable material approved by the Engineer, and clearly identified on or through the cover with at least the following information:

OPERATING AND MAINTENANCE INSTRUCTIONS

Name and Address of Work

Name of the Contractor

General subject of this manual

Space for approval signature of the Engineer and approval date(s)

D. Contents: Include at least the following:

1. Neatly typewritten index near the front of the Manual, giving immediate information as to the location within the manual of the emergency information regarding installation.
2. Complete instructions regarding the operation and maintenance of the equipment involved including lubrication, disassembly, and reassembly.
3. Complete nomenclature of the parts of equipment.
4. Complete nomenclature and part number of the replaceable parts, name and address of nearest vendor and other data pertinent to the procurement procedures.
5. Copy of guarantees and warranties issued.
6. Manufacturer's bulletins, cuts, and descriptive data, where pertinent, clearly indicating precise items included in this installation and deleting, or otherwise clearly indicating, manufacturers' data with which this installation is not concerned.
7. Other data as required in pertinent Sections of these Specifications.

1.16 EQUIPMENT FOUNDATIONS

- A. Provide equipment foundations in accordance with the provisions of these Specifications.
- B. Provide concrete bases for switchgear, switchboards, distribution panelboards, floor-mounted transformers, and other equipment that is to be pad or floor mounted. Bases shall be four (4) inches high above finished floors or grades (unless otherwise noted) and shall protrude a minimum of two (2) inches beyond the sides of the equipment and shall have exposed chamfered edges. Construct bases from ready-mixed hardrock concrete, ASTM C94, reinforced with #3 rebar, ASTM A615, Grade 40. Rebar shall be located at eighteen (18) inches on center in each direction.
- C. Field verify exact location of outdoor pad mounted equipment with the Engineer. Supply necessary fill and grade site to provide natural drainage away from the equipment.

1.17 TESTING AND INSPECTION



- A. Provide personnel and equipment, make required tests, and secure required approvals from the Engineer and Governmental Agencies having jurisdiction.
- B. Make written notice to the Engineer adequately in advance of each of the following stages of construction:
  - 1. When rough-in is complete, but not covered.
  - 2. At completion of the Work of this Division.
  - 3. In underground condition prior to placing backfill, concrete floor slab, and when associated electrical Work is in place.
- C. When material or workmanship is found to not comply with specified requirements, remove items from the job site and replace them with items complying with the specified requirements at no additional cost to the Owner. This shall be performed within three (3) days after receipt of the written notice of noncompliance.
- D. In the Engineer's presence, test parts of electrical system and prove that items provided under this Division function electrically in required manner.

#### 1.18 WARRANTY

- A. Warrant equipment and workmanship for a period of one (1) year after the date of substantial completion and replace or repair faulty equipment or installation at no cost to the Owner for service during this period, in accordance with the requirements of Division
- B. Warranty shall not void specific warranties issued by the manufacturers for greater periods of time or void rights guaranteed to the Owner by law.
- C. Warranties shall be in writing in form satisfactory to the Owner, and shall be delivered to the Owner before final payment is made.

#### 1.19 PROJECT COMPLETION

- A. Upon completion of the Work of this Division, thoroughly clean exposed portions of the electrical installation, removing traces of soil, labels, grease, oil, and other foreign material, and using only type cleaner recommended by the manufacturer of item being cleaned.
- B. Thoroughly indoctrinate the Owner's operation and maintenance personnel in the contents of the operations and maintenance manual required to be submitted as part of this Division of these Specifications.

END OF SECTION 26 01 00

THIS PAGE IS INTENTIONALLY LEFT BLANK

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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 wires and cables rated 600 V and less.
  - 2. Connectors, splices, and terminations rated 600 V and less.
- B. Related Requirements:
  - 1. Other Sections of Divisions 23, 26, 27 and 28.
  - 2. Other Divisions of Contract Documents. Refer to each Division's Specifications and Drawings for requirements.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene Monomer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.4 ACTION SUBMITTALS

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

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- 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. American Insulated Wire Corp.; a Leviton Company.
2. General Cable Corporation.
3. Southwire Company.

B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.

C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN.

D. Multi-conductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for armored cable, Type AC, Type SO, Type USE with ground wire and nonmetallic-sheathed cable, Type NM.

## 2.2 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. 3M.
2. Hubbell Power Systems, Inc.
3. Ideal Industries, Inc.
4. O-Z/Gedney.
5. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

## 2.3 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

## PART 3 - EXECUTION

### 3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

### 3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN/THWN, single conductors in raceway.

B. Exposed Feeders: Type THHN/THWN, single conductors in raceway.

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN, single conductors in raceway.

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN, single conductors in raceway.

E. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN, single conductors in raceway.

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions:

1. 1st Floor: Type THHN/THWN, single conductors in raceway.
  2. Floor 2 -5: Type NM and type THHN/THWN, single conductors in raceway.
  3. Roof: Type THHN/THWN, single conductors in raceway.
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN, single conductors in raceway.
- H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, and strain relief device at terminations to suit application.
- I. Minimum wire size shall be #12 for power. All runs over 100' shall be a minimum of #10.
- J. Minimum wire size shall be #14 for controls.

### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."
- G. Type NM cable shall not be terminated directly to circuit breakers in panelboards or switchboards. Cable shall be connected to a terminal strip located in a wireway above the panelboard.
- H. No more than three (3) Type NM cables shall be bundled together and installed in a single opening in the wood structure or walls.

### 3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

### 3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

### 3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

### 3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 07 84 13 "Firestopping" and Section 07 84 00 13 "Firestopping Schedule."

### 3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform the following tests and inspections:
  - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
  - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.
    - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
    - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    - c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.
- C. Test and Inspection Reports: Prepare a written report to record the following:
  - 1. Procedures used.
  - 2. Results that comply with requirements.
  - 3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- D. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION 26 05 19

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
  - 1. Grounding conductors.
  - 2. Grounding connectors.
  - 3. Grounding busbars.
  - 4. Grounding rods.
  - 5. Grounding labeling.
- B. Grounding and bonding systems and equipment.

1.3 DEFINITIONS

- A. BCT: Bonding conductor for telecommunications.
- B. EMT: Electrical metallic tubing.
- C. TGB: Telecommunications grounding busbar.
- D. TMGB: Telecommunications main grounding busbar.

1.4 ACTION SUBMITTALS

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

1.5 INFORMATIONAL SUBMITTALS

- A. As-Built Data: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
  - 1. Test wells.
  - 2. Ground rods.
  - 3. Ground rings.
  - 4. Grounding arrangements and connections for separately derived systems.
  - 5. BCT, TMGB, TGBs, and routing of their bonding conductors.
- B. Qualification Data: For testing agency and testing agency's field supervisor.
- C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
  - a. Instructions for periodic testing and inspection of grounding features at test wells, ground rings and grounding connections for separately derived systems based on NFPA 70B.
    1. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
    2. Include recommended testing intervals.
  - b. Result of the ground-resistance test, measured at the point of BCT connection.
  - c. Result of the bonding-resistance test at each TGB and its nearest grounding electrode.

## 1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
  1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with UL 467 for grounding and bonding materials and equipment.

## PART 2 - PRODUCTS

### 2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

### 2.2 CONDUCTORS

- A. Insulated Conductors: Stranded copper wire, green or green with yellow stripe insulation, insulated for 600 V.
  1. Ground wire for custom-length equipment ground jumpers shall be No. 6 AWG, 19-strand, UL-listed, Type THHN wire.
  2. Cable Tray Equipment Grounding Wire: No. 8 AWG.
- B. Cable Tray Grounding Jumper:
  1. Not smaller than No. 6 AWG and no longer than 12 inches. If jumper is a wire, it shall have a crimped grounding lug with two holes and long barrel for two crimps. If jumper is a flexible braid, it shall have a one-hole ferrule. Attach with grounding screw or connector provided by cable tray manufacturer.
- C. Bare Copper Conductors:
  1. Solid Conductors: ASTM B 3.
  2. Stranded Conductors: ASTM B 8.



3. Tinned Conductors: ASTM B 33.
  4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
  5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
  6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- D. Grounding Bus: Predrilled rectangular bars of annealed copper with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V. Dimensions shall be as shown on the plans or as required for the application.

## 2.3 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

## 2.4 GROUNDING BUSBARS

- A. TMGB: Predrilled, wall-mounted, rectangular bars of hard-drawn solid copper, 1/4 by 4 inches in cross section and 24 inches long. The busbar shall be NRTL listed for use as TMGB and shall comply with J-STD-607-A.
  1. Predrilling shall be with holes for use with lugs specified in this Section.
  2. Mounting Hardware: Stand-off brackets that provide a 4-inch clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
  3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.
- B. TGB: Predrilled rectangular bars of hard-drawn solid copper, 1/4 by 2 inches in cross section and 24 inches long. The busbar shall be for wall mounting, shall be NRTL listed as complying with UL 467, and shall comply with J-STD-607-A.
  1. Predrilling shall be with holes for use with lugs specified in this Section.
  2. Mounting Hardware: Stand-off brackets that provide at least a 2-inch clearance to access the rear of the busbar. Brackets and bolts shall be stainless steel.
  3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.

## 2.5 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet.

## PART 3 - EXECUTION

### 3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
  - 1. The bonding conductors between the TGB and structural steel of steel-frame buildings shall not be smaller than No. 6 AWG.
  - 2. The bonding conductors between the TMGB and structural steel of steel-frame buildings shall not be smaller than No. 6 AWG.
- B. Underground Grounding Conductors: Install bare copper conductor, No. 4/0 AWG minimum.
  - 1. Duct-Bank Grounding Conductor: install in duct bank as indicated.
- C. Grounding Bus: Install in electrical and telephone/data equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
  - 1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
  - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.
- D. Conductor Terminations and Connections:
  - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
  - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
  - 4. Connections to Structural Steel: Welded connectors.

### 3.2 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.
- B. The BCT between the TMGB and the ac service equipment ground shall be minimum No. 1/0 AWG.

### 3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

### 3.4 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:

1. Feeders and branch circuits.
  2. Lighting circuits.
  3. Receptacle circuits.
  4. Single-phase motor and appliance branch circuits.
  5. Three-phase motor and appliance branch circuits.
  6. Flexible raceway runs.
  7. Armored and metal-clad cable runs.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- E. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.
- F. Bond metallic equipment in a telecommunications equipment room to the grounding busbar in that room, using equipment grounding conductors not smaller than No. 6 AWG.
- G. Stacking of conductors under a single bolt is not permitted when connecting to busbars.
- H. Primary Protector: Bond to the TMGB with insulated bonding conductor.
- I. Interconnections: Interconnect all TGBs with the TMGB with the telecommunications backbone conductor. If more than one TMGB is installed, interconnect TMGBs using the grounding equalizer conductor. The telecommunications backbone conductor and grounding equalizer conductor size shall not be less than 2 kcmils/linear foot of conductor length, up to a maximum size of No. 3/0 AWG unless otherwise indicated.
- J. Telecommunications Enclosures and Equipment Racks: Bond metallic components of enclosures to the telecommunications bonding and grounding system. Bond the equipment grounding busbar to the TGB No. 2 AWG bonding conductors.

### 3.5 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.

2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 260543 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches deep, with cover.
  1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
- E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
  1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
  3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- F. Grounding and Bonding for Piping:
  1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
  2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
  3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
- H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.
- I. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each indicated item, extending around the perimeter of building.
  1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
  2. Bury ground ring not less than 24 inches from building's foundation.

### 3.6 IDENTIFICATION

- A. Labels shall be preprinted or computer-printed type.
  1. Label TMGB(s) with "fs-TMGB," where "fs" is the telecommunications space identifier for the space containing the TMGB.

2. Label TGB(s) with "fs-TGB," where "fs" is the telecommunications space identifier for the space containing the TGB.
3. Label the BCT and each telecommunications backbone conductor at its attachment point: "WARNING! TELECOMMUNICATIONS BONDING CONDUCTOR. DO NOT REMOVE OR DISCONNECT!"

### 3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
  1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
  2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
  3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal and at ground test wells. Make tests at ground rods before any conductors are connected.
    - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    - b. Perform tests by fall-of-potential method according to IEEE 81.
  4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- D. Grounding system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.
- F. Report measured ground resistances that exceed the following values:
  1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
  2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
  3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
  4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm.
  5. Substations and Pad-Mounted Equipment: 5 ohms.
  6. Manhole Grounds: 10 ohms.
- G. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26

THIS PAGE IS INTENTIONALLY LEFT BLANK

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

- 1. Hangers and supports for electrical equipment and systems.
  - 2. Construction requirements for concrete bases.

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 the following:
    - a. Hangers.
    - b. Steel slotted support systems.
    - c. Nonmetallic support systems.
    - d. Trapeze hangers.
    - e. Clamps.
    - f. Turnbuckles.
    - g. Sockets.
    - h. Eye nuts.
    - i. Saddles.
    - j. Brackets.
  - 2. Include rated capacities and furnished specialties and accessories.

- B. Shop Drawings: Signed and sealed by a qualified professional engineer. For fabrication and installation details for electrical hangers and support systems.

- 1. Trapeze hangers. Include product data for components.
  - 2. Steel slotted-channel systems.
  - 3. Nonmetallic slotted-channel systems.
  - 4. Equipment supports.
  - 5. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:

- 1. AWS D1.1/D1.1M.

2. AWS D1.2/D1.2M.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

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

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Allied Tube & Conduit.
- b. Cooper B-Line, Inc.; a division of Cooper Industries.
- c. ERICO International Corporation.
- d. GS Metals Corp.
- e. G-Strut.
- f. Thomas & Betts Corporation, A Member of the ABB Group.
- g. Unistrut; an Atkore International company.
- h. Wesanco, Inc.

2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
5. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
6. Channel Dimensions: Selected for applicable load criteria.

- B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.

- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.

- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

- a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:



1. Hilti, Inc.
  2. ITW Ramset/Red Head; Illinois Tool Works, Inc.
  3. MKT Fastening, LLC.
  4. Simpson Strong-Tie Co., Inc.
2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    1. Cooper B-Line, Inc.; a division of Cooper Industries.
    2. Empire Tool and Manufacturing Co., Inc.
    3. Hilti, Inc.
    4. ITW Ramset/Red Head; Illinois Tool Works, Inc.
    5. MKT Fastening, LLC.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

## 2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems unless requirements in this Section are stricter.
- B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as scheduled in NECA 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- D. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  1. Secure raceways and cables to these supports with two-bolt conduit clamps.

- E. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

### 3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMTs, IMCs, and RMCs may be supported by openings through structure members, according to NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To New Concrete: Bolt to concrete inserts.
  - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 4. To Existing Concrete: Expansion anchor fasteners.
  - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
  - 6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
  - 7. To Light Steel: Sheet metal screws.
  - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

### 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

### 3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.

- B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast-in-Place Concrete."
- C. Anchor equipment to concrete base as follows:
  - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

### 3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touchup: Comply with requirements in Division 09 for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29

THIS PAGE IS INTENTIONALLY LEFT BLANK

SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetal conduits, tubing, and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Boxes, enclosures, and cabinets.
6. Floor boxes.

B. Related Requirements:

1. Section 260543 – "Underground Ducts and Raceways for Electrical Systems"
2. Section 270528 – "Pathways for Communications Systems"

1.3 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
  1. Structural members in paths of conduit groups with common supports.
  2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- B. Qualification Data: For professional engineer.
- C. Source quality-control reports.

## PART 2 - PRODUCTS

### 2.1 METAL CONDUITS, TUBING, AND FITTINGS

- 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. Allied Tube & Conduit.
  2. O-Z/Gedney
  3. Southwire Company.
  4. Thomas & Betts Corporation, A Member of the ABB Group.
  5. Western Tube and Conduit Corporation.
  6. Wheatland Tube Company.
- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. ARC: Comply with ANSI C80.5 and UL 6A.
- E. IMC: Comply with ANSI C80.6 and UL 1242.
- F. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
1. Comply with NEMA RN 1.
  2. Coating Thickness: 0.040 inch, minimum.
- G. EMT: Comply with ANSI C80.3 and UL 797.
- H. FMC: Comply with UL 1; zinc-coated steel.
- I. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- J. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
  2. Fittings for EMT:
    - a. Material: Steel.
    - b. Type: Compression.
  3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
  4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.
- K. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

### 2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- 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. AFC Cable Systems, Inc.
  2. Arnco Corporation.

3. RACO; Hubbell.
  4. Thomas & Betts Corporation, A Member of the ABB Group.
- B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. ENT: Comply with NEMA TC 13 and UL 1653.
- D. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- E. LFNC: Comply with UL 1660.
- F. Rigid HDPE: Comply with UL 651A.
- G. Continuous HDPE: Comply with UL 651B.
- H. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D 3485.
- I. RTRC: Comply with UL 1684A and NEMA TC 14.
- J. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- K. Fittings for LFNC: Comply with UL 514B.
- L. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## 2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- 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. Cooper B-Line, Inc.; a division of Cooper Industries.
  2. Hoffman; a brand of Pentair Equipment Protection.
  3. MonoSystems, Inc.
  4. Square D.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type as indicated on the plans and sized according to NFPA 70.
1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Hinged type unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

## 2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

- 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. Allied Moulded Products, Inc.
  - 2. Hoffman; a brand of Pentair Equipment Protection.
- B. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.
- D. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

## 2.5 BOXES, ENCLOSURES, AND CABINETS

- 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. Cooper Technologies Company.
  - 2. EGS/Appleton Electric.
  - 3. Hoffman; a brand of Pentair Equipment Protection.
  - 4. Hubbell Incorporated.
  - 5. O-Z/Gedney.
  - 6. RACO; Hubbell.
  - 7. Thomas & Betts Corporation, A Member of the ABB Group.
  - 8. Wiremold / Legrand.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, Type FD, with gasketed cover.
- E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.
- G. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.
  - 1. Listing and Labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- I. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.



- J. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- K. Device Box Dimensions: 4 inches by 2-1/8 inches by 2-1/8 inches deep.
- L. Gangable boxes are allowed.
- M. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type as indicated on the plans with continuous-hinge cover with flush latch unless otherwise indicated.
  - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
  - 2. Nonmetallic Enclosures: Plastic.
  - 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- N. Cabinets:
  - 1. NEMA 250, Type as indicated on plans, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
  - 2. Hinged door in front cover with flush latch and concealed hinge.
  - 3. Key latch to match panelboards.
  - 4. Metal barriers to separate wiring of different systems and voltage.
  - 5. Accessory feet where required for freestanding equipment.
  - 6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## 2.6 FLOOR BOXES

- A. Classification and Use: Floor boxes shall have been examined and tested by Underwriters Laboratories Inc. to meet UL514A and/or UL514C and Canadian Standard C22.2, No. 18.1-04 and 18.2-06 and bear the U.S. and Canadian UL Listing Mark. Floor boxes shall also have been tested by Underwriters Laboratories Inc. and classified for fire resistance and bear the U.S. and Canadian UL Classification Mark. Devices shall be classified for use in 2-hour rated, unprotected reinforced concrete floors and 2-hour rated floors employing unprotected steel floor units and concrete toppings or concrete floors with suspended ceilings (fire resistive designs with suspended ceilings should have provisions for accessibility in the ceiling below the floor boxes). Floor boxes shall also conform to the standards set in Section 300-21 of the National Electrical Code. Floor boxes shall meet UL scrub water requirements, but are not suitable for wet or damp locations, or other areas subject to saturation with water or other liquids such as commercial kitchens. Floor boxes shall also have been evaluated by UL to meet the applicable U.S. and Canadian safety standards for scrub water exclusion when used on tile, bare concrete, terrazzo, wood, and carpet covered floors. Floor boxes shall be suitable for use in air handling spaces in accordance with Section 300-22 (C) of the National Electrical Code.
- B. Floor Boxes, General: Floor Boxes for use on above grade concrete floors, raised floors or wood floors. Provide boxes with a component to permit installation in polished concrete or terrazzo floors.
  - 1. Floor boxes provide the interface between power, communication and audio/video (A/V) cabling in above-grade floors, on-grade concrete floors, raised floors, wood floors, and fire-classified floors and the workstation or activation location where power and communication and/or A/V device outlets are required.
  - 2. Boxes shall provide recessed device outlets that will not obstruct the floor area. Refer to Drawings for size and types.
- C. Floor Boxes:

1. Manufactured from stamped steel approved for use on above grade concrete floors, raised floors and wood floors with the same product.
2. Boxes shall have the ability to be installed in polished concrete or terrazzo floors.
3. Boxes shall have a polyester based backed enamel finished interior.
4. Provide boxes with provisions that enable installation into concrete floors, raised floors, or wood floors without having to purchase additional components or accessories.
5. Provide boxes with six (6) independent wiring compartments that allow for up to six (6) receptacles, communication and/or audio/video services.
6. Boxes shall have removable and relocatable dividers to permit custom configuration of compartments as well as permit feed to adjacent compartments.
7. Boxes shall permit feed to compartments on the opposite side of the box through a tunnel.
8. Provide boxes with removable compartments to facilitate installation and moves, additions, and changes. The compartments shall be removable from the top and back of the floor box.
9. Provide boxes with two (2) cable guides to organize and maintain the cables egress out of the box.
10. Provide boxes with removable knockout plates to allow for the maximum cable pass-through area.
11. The box shall contain the following number of knockouts: ten (10) 1" trade size, six (6) 1-1/4" trade size, six (6) 3/4" trade size, and two (2) 2" trade size.
12. Boxes shall be fully adjustable, accommodating a maximum 2-inch pre-concrete pour and a maximum 1/2" post-concrete pour adjustment.
13. Equip boxes with toggle clamps to allow box to be secured to raised and wood floors.
14. The box shall be able to accept 2-3/4" x 4-1/2" standard size wall plates.
15. Provide with two (2) 20-amp duplex receptacles, two (2) six provision snap-in data modules and two (2) compartments for audio/video connections as coordinated with A/V vendor.
16. Flush Covers: Manufactured of die-cast aluminum. Provide covers with two (2) gaskets (one (1) for carpet and one (1) for tile) to go under the trim flange to maintain scrub water tightness. Covers shall be available with a carpet recess area or a solid lid. Secure the cover to the flange and enable cover to rotate greater than 180 degrees to reduce trip hazards and provide maximum amount of working space. Provide covers with spring-loaded self-closing slide egress doors to reduce egress opening when cables are exiting and reduce trip hazards. Each of the two (2) egress openings. Cover have powder coat finish, color shall be black.
17. Box shall be equal to Wiremold EFB6S.

### PART 3 - EXECUTION

#### 3.1 RACEWAY APPLICATION

A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC
2. Concealed Conduit, Aboveground: EMT
3. Underground Conduit: RNC, Type EPC-80-PVC.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

B. Indoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:

- a. Loading dock.
  - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
  - c. Mechanical rooms.
- 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
- 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
- 6. Damp or Wet Locations: GRC.
- 7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 nonmetallic in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch trade size, indoors and 1-inch trade size outdoors.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
  - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
  - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealants recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
  - 3. EMT: Use compression; raintight, steel fittings. Comply with NEMA FB 2.10.
  - 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- G. Install surface raceways only where indicated on Drawings.
- H. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

### 3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches of enclosures to which attached.
- I. Raceways Embedded in Slabs:
  - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
  - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
  - 3. Arrange raceways to keep a minimum of 1 inch of concrete cover in all directions.
  - 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
  - 5. Change from PVC to Rigid before rising above floor.
- J. Stub-ups to Above Recessed Ceilings:
  - 1. Use EMT, IMC, or RMC for raceways.
  - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- L. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- N. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- P. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- Q. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- R. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- S. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  2. Where an underground service raceway enters a building or structure.
  3. Where otherwise required by NFPA 70.
- T. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- U. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
  2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
    - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
    - d. Attics: 135 deg F temperature change.
  3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
  4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
  5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- V. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
- W. Use LFMC in damp or wet locations subject to severe physical damage.
- X. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- Y. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- Z. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- AA. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- BB. Locate boxes so that cover or plate will not span different building finishes.

- CC. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- DD. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- EE. Set floor boxes level and flush with finished floor surface.

### 3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

### 3.4 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 84 13 "Firestopping" and Section 07 84 00 13 "Firestopping Schedule."

### 3.5 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 26 05 33

## SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

1. Identification for raceways.
2. Identification of power and control cables.
3. Identification for conductors.
4. Underground-line warning tape.
5. Warning labels and signs.
6. Instruction signs.
7. Equipment identification labels, including arc-flash warning labels.
8. Miscellaneous identification products.

#### 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 electrical identification products.
- B. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.
- C. Delegated-Design Submittal: For arc-flash hazard study.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.
- F. 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 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:
  - 1. Black letters on a white field.
  - 2. Legend: Indicate voltage and system or service type.
- B. Raceways and Cables Carrying Circuits at More Than 600 V:
  - 1. Black letters on an orange field.
  - 2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."
- C. Warning labels and signs shall include, but are not limited to, the following legends:
  - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

## 2.3 TAPES AND STENCILS:

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.
- C. Underground-Line Warning Tape
  - 1. Tape:
    - a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
    - b. Printing on tape shall be permanent and shall not be damaged by burial operations.
    - c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
  - 2. Color and Printing:
    - a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
    - b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE"
    - c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".
- D. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

## 2.4 SIGNS

- A. Laminated Acrylic or Melamine Plastic Signs:
  - 1. Engraved legend.
  - 2. Thickness:
    - a. For signs up to 20 sq. inches, minimum 1/16 inch thick.



- b. For signs larger than 20 sq. inches, 1/8 inch thick.
- c. Engraved legend with white letters on a black background>.
- d. Self-adhesive.
- e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

## 2.5 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

### 3.2 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- G. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
- H. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.
- I. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- J. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

- K. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

### 3.3 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels containing the wiring system legend and system voltage. System legends shall be as follows:
  - 1. "EMERGENCY POWER."
  - 2. "POWER."
  - 3. "UPS."
- B. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
  - 1. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed on plans in "GENERAL NOTES FOR ALL ELECTRICAL WORK".
- C. Install instructional sign, including the color code for grounded and ungrounded conductors using adhesive-film-type labels.
- D. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive vinyl labels with the conductor or cable designation, origin, and destination.
- E. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive vinyl labels with the conductor designation.
- F. Conductors To Be Extended in the Future: Attach marker tape to conductors and list source.
- G. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
  - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
  - 2. Use system of marker-tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
  - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- H. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
  - 1. Install underground-line warning tape for direct-buried cables and cables in raceways.
- I. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- J. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
  - 1. Comply with 29 CFR 1910.145.

2. Identify system voltage with black letters on an orange background.
  3. Apply to exterior of door, cover, or other access.
  4. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
    - a. Power-transfer switches.
    - b. Controls with external control power connections.
- K. Arc Flash Warning Labeling: Self-adhesive thermal transfer vinyl labels.
1. Comply with NFPA 70E and ANSI Z535.4.
  2. Comply with Section 260574 "Overcurrent Protective Device Arc-Flash Study" requirements for arc-flash warning labels.
- L. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- M. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.
- N. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm unless equipment is provided with its own identification.
1. Labeling Instructions:
    - a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine plastic label. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
    - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
    - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
    - d. Unless labels are provided with self-adhesive means of attachment, fasten them with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
  2. Equipment To Be Labeled:
    - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a self-adhesive, engraved, laminated acrylic or melamine label.
    - b. Enclosures and electrical cabinets.
    - c. Access doors and panels for concealed electrical items.
    - d. Switchgear.
    - e. Switchboards.
    - f. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
    - g. Substations.
    - h. Emergency system boxes and enclosures.
    - i. Motor-control centers.

- j. Enclosed switches.
- k. Enclosed circuit breakers.
- l. Enclosed controllers.
- m. Variable-speed controllers.
- n. Push-button stations.
- o. Power-transfer equipment.
- p. Contactors.
- q. Remote-controlled switches, dimmer modules, and control devices.
- r. Battery-inverter units.
- s. Battery racks.
- t. Power-generating units.
- u. Monitoring and control equipment.
- v. UPS equipment.

END OF SECTION 26 05 53

## SECTION 26 24 16 - PANELBOARDS

### 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. Lighting and appliance branch-circuit panelboards.

#### 1.3 DEFINITIONS

- A. ATS: Acceptance testing specification.
- B. GFCI: Ground-fault circuit interrupter.
- C. GFEP: Ground-fault equipment protection.
- D. HID: High-intensity discharge.
- E. MCCB: Molded-case circuit breaker.
- F. VPR: Voltage protection rating.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard.
  - 1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
  - 2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
  - 1. Include dimensioned plans, elevations, sections, and details.
  - 2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
  - 3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
  - 4. Detail bus configuration, current, and voltage ratings.
  - 5. Short-circuit current rating of panelboards and overcurrent protective devices.
  - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
  - 7. Include wiring diagrams for power, signal, and control wiring.
  - 8. Key interlock scheme drawing and sequence of operations.
  - 9. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graph paper; include selectable ranges for each type of overcurrent protective device. Include an Internet link for electronic access to downloadable PDF of the coordination curves.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
  2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Keys: Two spares for each type of panelboard cabinet lock.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.10 FIELD CONDITIONS

- A. Environmental Limitations:
1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
  2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
    - a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
    - b. Altitude: Not exceeding 6600 feet.
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
1. Ambient temperatures within limits specified.
  2. Altitude not exceeding 6600 feet.
- C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:

1. Notify Owner no less than one week in advance of proposed interruption of electric service.
2. Do not proceed with interruption of electric service without Owner's written permission.
3. Comply with NFPA 70E.

#### 1.11 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURES

- A. Manufacturers: Subject to compliance with requirements, provide products by Square D; by Schneider Electric.

#### 2.2 PANELBOARDS REQUIREMENTS

- A. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA PB 1.
- D. Comply with NFPA 70.
- E. Enclosures: Flush or Surface-mounted, dead-front cabinets as indicated on the plans.
1. Rated for environmental conditions at installed location, unless noted otherwise on the plans.
    - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
    - b. Outdoor Locations: NEMA 250, Type 3R.
    - c. Kitchen Areas: NEMA 250, Type 1, stainless steel cover.
    - d. Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
    - e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
  2. Height: 84 inches maximum.
  3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
  4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
  5. Finishes:
    - a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    - b. Back Boxes: Same finish as panels and trim.

F. Incoming Mains:

1. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.

G. Phase, Neutral, and Ground Buses:

1. Material: Hard-drawn copper, 98 percent conductivity.
  - a. Plating shall run entire length of bus.
  - b. Bus shall be fully rated the entire length.
2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
4. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box, where required, refer to plans.
5. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.
6. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and listed and labeled by an NRTL acceptable to authority having jurisdiction, as suitable for nonlinear loads in electronic-grade panelboards and others designated on Drawings. Connectors shall be sized for double-sized or parallel conductors as indicated on Drawings. Do not mount neutral bus in gutter.

H. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Terminations shall allow use of 75 deg C rated conductors without derating.
3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
6. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
7. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
8. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material and with matching insulating covers. Locate at same end of bus as incoming lugs or main device.
9. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.

I. NRTL Label: Panelboards shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards or load centers shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.

J. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices as indicated on the plans.

K. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.



1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.
2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

## 2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- B. Mains: As indicated on the plans.
- C. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.
- D. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.
- E. Column-Type Panelboards: Where indicated on the plans, provide a single row of overcurrent devices.
  1. Doors: Concealed hinges secured with multipoint latch with tumbler lock; keyed alike.

## 2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
  1. Thermal-Magnetic Circuit Breakers:
    - a. Inverse time-current element for low-level overloads.
    - b. Instantaneous magnetic trip element for short circuits.
    - c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  2. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
  3. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
  4. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
  5. Subfeed Circuit Breakers: Vertically mounted.
  6. MCCB Features and Accessories:
    - a. Standard frame sizes, trip ratings, and number of poles.
    - b. Breaker handle indicates tripped status.
    - c. UL listed for reverse connection without restrictive line or load ratings.
    - d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    - e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
    - f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
    - g. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.

- h. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
- i. Rating Plugs: Three-pole breakers with ampere ratings greater than 150 amperes shall have interchangeable rating plugs or electronic adjustable trip units.
- j. Auxiliary Contacts: One, SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
- k. Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.
- l. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
- m. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function with other upstream or downstream devices.
- n. Multipole units enclosed in a single housing with a single handle.
- o. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handles in off position.

## 2.5 IDENTIFICATION

- A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.
- B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.
- C. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.
  - 1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.
- B. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.
- D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces.

Maintain required workspace clearances and required clearances for equipment access doors and panels.

- B. Comply with NECA 1.
- C. Install panelboards and accessories according to NEMA PB 1.1.
- D. Equipment Mounting:
  - 1. Install panelboards on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in other sections of these specifications.
  - 2. Attach panelboard to the vertical finished or structural surface behind the panelboard.
- E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- F. Mount top of trim 90 inches above finished floor unless otherwise indicated.
- G. Mount panelboard cabinet plumb and rigid without distortion of box.
- H. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- I. Mounting panelboards with space behind is recommended for damp, wet, or dirty locations. The steel slotted supports in the following paragraph provide an even mounting surface and the recommended space behind to prevent moisture or dirt collection.
- J. Mount surface-mounted panelboards to steel slotted supports 5/8 inch in depth. Orient steel slotted supports vertically.
- K. Install overcurrent protective devices and controllers not already factory installed.
  - 1. Set field-adjustable, circuit-breaker trip ranges.
  - 2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.
- L. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
- M. Install filler plates in unused spaces.
- N. For recessed panelboards, stub six (6) 1-inch empty EMT conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub six (6) 1-inch empty conduits into raised floor space or below slab not on grade.
- O. For floors 2 through 5, provide wireways above panelboard for transition of type NM cable to conduit and wire. Mount wireway as high as possible on wall above panelboard with internal terminal strip(s). Terminate type NM cable and wire on strip. Extend conduit and wiring from wireway to panelboard.

### 3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."

- B. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- C. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- D. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

### 3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- C. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA ATS, Paragraph 7.6 Circuit Breakers. Do not perform optional tests. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  - 3. Perform the following infrared scan tests and inspections and prepare reports:
    - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
    - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
    - c. Instruments and Equipment:
      - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

### 3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

- B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study".

### 3.6 PROTECTION

- A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 26 24 16

THIS PAGE IS INTENTIONALLY LEFT BLANK

## SECTION 26 27 26 - WIRING DEVICES

### 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. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Twist-locking receptacles.
3. Weather-resistant receptacles.
4. Snap switches and wall-box dimmers.
5. Solid-state fan speed controls.
6. Wall-switches.
7. Occupancy Sensors.
8. Switch mounted Occupancy Sensors.
9. Communications outlets.
10. Pendant cord-connector devices.
11. Cord and plug sets.

#### 1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.
- F. UTP: Unshielded twisted pair.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
  2. Cord and Plug Sets: Match equipment requirements.

#### 1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

## 1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

## 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. Cooper Wiring Devices, Inc.; Division of Cooper Industries, Inc.
  - 2. Hubbell Incorporated; Wiring Device-Kellems.
  - 3. Leviton Manufacturing Co., Inc.
  - 4. Pass & Seymour/Legrand (Pass & Seymour).
- B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

### 2.2 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

### 2.3 STRAIGHT-BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
- B. Convenience Duplex Receptacles with Combination USB Charger, 125V, 20A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 & UL 1310
  - 1. 20A duplex receptacle
  - 2. Dual USB charging ports
  - 3. USB Power Supply – 5V/DC 2.1A minimum
  - 4. Tamper Resistant

### 2.4 GFCI RECEPTACLES

- A. General Description:
  - 1. Straight blade, non-feed-through type.
  - 2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
  - 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

### 2.5 TWIST-LOCKING RECEPTACLES

- A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.



B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:

1. Comply with NEMA WD 1, NEMA WD 6 Configuration L5-20R, and UL 498.
2. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

2.6 PENDANT CORD-CONNECTOR DEVICES

A. Description:

1. Matching, locking-type plug and receptacle body connector.
2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596. Refer to plans for additional configuration requirements.
3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.7 CORD AND PLUG SETS

A. Description:

1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.8 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Switches, 120/277 V, 20 A:

C. Pilot-Light Switches, 20 A:

1. Description: Single pole, with neon-lighted handle, illuminated when switch is "off."

D. Key-Operated Switches, 120/277 V, 20 A:

1. Description: Single pole, with factory-supplied key in lieu of switch handle.

E. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors.

F. Key-Operated, Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

## 2.9 OCCUPANCY SENSORS

- A. Manufacturers: Refer to plans for manufacturer and model numbers of occupancy sensors used for design. Provide occupancy sensors equal to the devices specified on the plans.
- B. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
  - 3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
  - 4. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
  - 5. Mounting:
    - a. Sensor: Suitable for mounting in any position on a standard outlet box.
    - b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
    - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
  - 6. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
  - 7. Bypass Switch: Override the "on" function in case of sensor failure.
  - 8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.
- C. PIR Type: Ceiling mounted; detect occupants in coverage area by their heat and movement.
  - 1. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in.
  - 2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.
  - 3. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot-high ceiling.
- D. Ultrasonic Type: Ceiling mounted; detect occupants in coverage area through pattern changes of reflected ultrasonic energy.
  - 1. Detector Sensitivity: Detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
  - 2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. when mounted on a 96-inch-high ceiling.
  - 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.
  - 4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch-high ceiling.
  - 5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet when mounted on a 10-foot-high ceiling in a corridor not wider than 14 feet.

- E. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.
  - 1. Sensitivity Adjustment: Separate for each sensing technology.
  - 2. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
  - 3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.

#### 2.10 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

- A. Manufacturers: Refer to plans for manufacturer and model numbers of occupancy sensors used for design. Provide occupancy sensors equal to the devices specified on the plans.
- B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
  - 3. Switch Rating: Not less than 800-VA fluorescent at 120 V, 1200-VA fluorescent at 277 V, and 800-W incandescent.
- C. Wall-Switch Sensor:
  - 1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of 900 sq. ft.
  - 2. Sensing Technology: PIR.
  - 3. Switch Type: Single- or dual-pole as indicated on the plans with field selectable automatic "on," or manual "on" automatic "off."
  - 4. Voltage: Dual voltage, 120 and 277 V.
  - 5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
  - 6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
  - 7. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.

#### 2.11 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable slider with toggle switch; with single-pole, three- or four-way switching. Comply with UL 1472.
- C. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

#### 2.12 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
  2. Material for Finished Spaces: Smooth, high-impact nylon.
  3. Material for Unfinished Spaces: Galvanized steel.
  4. Material for Damp Locations: Thermoplastic spring-loaded lift cover, and listed and labeled for continuous use in wet and damp locations.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover and rated for continuous use.

## 2.13 FINISHES

- A. Device Color:
1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
- B. Wall Plate Color: For nylon covers, match device color.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
  2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
  3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
  4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
  2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
  3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
  4. Existing Conductors:
    - a. Cut back and pigtail, or replace all damaged conductors.
    - b. Straighten conductors that remain and remove corrosion and foreign matter.
    - c. Pig tailing existing conductors is permitted, provided the outlet box is large enough.
- D. Device Installation:
1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.

2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left.
2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of service poles to suit arrangement of partitions and furnishings.

### 3.2 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

### 3.3 SENSOR INSTALLATION

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- B. It shall be the contractor's responsibility to locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have ninety (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room.

- C. Provide the correct quantity of Power Packs for the switching shown on the plans. Power Packs are not shown on the plans.

### 3.4 IDENTIFICATION

- A. Comply with Section 260553 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes. Provide labeling for light switches on the inside of the wall plate.

### 3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Test Instruments: Use instruments that comply with UL 1436.
  - 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- B. Tests for Convenience Receptacles:
  - 1. Line Voltage: Acceptable range is 105 to 132 V.
  - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
  - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
  - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
  - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
  - 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- C. Test straight-blade convenience outlets in patient-care areas and hospital-grade convenience outlets for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz.
- D. Wiring device will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

END OF SECTION 26 27 26

## SECTION 26 51 16 - INTERIOR LIGHTING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. All lighting fixtures specified as addenda in drawings or missives by the architect, engineer, or MSU.

#### 1.2 SUMMARY

- A. Section Includes all interior fixtures including but not limited to:
  - 1. Interior LED fixtures.
  - 2. Luminaire supports.
- B. Related Requirements:
  - 1. Refer to Lighting Fixture Schedule on the plans.
  - 2. Section 260923 "Lighting Control Devices".
  - 3. Section 262726 "Wiring Devices".

#### 1.3 DEFINITIONS

- A. BIM: Building information model.
- B. CAD: Computer-aided design.
- C. CCT: Correlated color temperature.
- D. CRI: Color Rendering Index.
- E. Fixture: See "Luminaire."
- F. IP: International Protection or Ingress Protection Rating
- G. HID: High-intensity discharge.
- H. LED: Light-emitting diode.
- I. Lumen: Measured output of lamp and luminaire, or both.
- J. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Arrange in order of luminaire designation.
  - 2. Include data on features, accessories, and finishes.
  - 3. Include physical description and dimensions of luminaires.
  - 4. Ballast, including BF.
  - 5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.

6. Include photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps, ballasts, and accessories identical to those indicated for the luminaire as applied in this Project.
  7. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
  8. Air and Thermal Performance Data: For air-handling luminaires. Furnish data required in "Action Submittals" Article in Section 233713 "Diffusers, Registers, and Grilles."
  9. Sound Performance Data: For air-handling luminaires. Indicate sound power level and sound transmission class in test reports certified according to standards specified in Section 233713 "Diffusers, Registers, and Grilles."
- B. Shop Drawings: For nonstandard or custom luminaires.
1. Include plans, elevations, sections, and mounting and attachment details.
  2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, and required clearances, method of field assembly, components, and location and size of each field connection.
  3. Include diagrams for power, signal, and control wiring.
- C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing laboratory providing photometric data for luminaires.
- B. Product Certificates: For each type of ballast for bi-level and dimmer-controlled luminaires, from manufacturer.
- C. Product Test Reports: For each luminaire, for tests performed by a qualified testing agency.
- D. Sample warranty.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in maintenance manuals.
1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

#### 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.

#### 1.8 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory is accredited under the NVLAP for Energy Efficient Lighting Products.



1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

- 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- D. UL Compliance: Comply with UL 1598.
- E. Lamp base complying with ANSI C81.61.
- F. Nominal Operating Voltage: Refer to Lighting Fixture Schedule on the plans.
- G. Recessed Luminaires: Comply with NEMA LE 4.

2.2 MATERIALS

- A. Metal Parts:
  - 1. Free of burrs and sharp corners and edges.
  - 2. Sheet metal components shall be steel unless otherwise indicated.
  - 3. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- C. Diffusers and Globes: Refer to Lighting Fixture Schedule on the plans.
- D. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
  - 1. Label shall include the following lamp characteristics:
    - a. "USE ONLY" and include specific lamp type.
    - b. Lamp diameter, shape, size, wattage, and coating.

- c. CCT and CRI for all luminaires.

## 2.3 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

## 2.4 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish shall match luminaire.
- C. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.
- D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 TEMPORARY LIGHTING

- A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

### 3.3 INSTALLATION

- A. Comply with NECA 1.
- B. Remote Mounting of Ballasts: Distance between the ballast and luminaire shall not exceed that recommended by ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.
- C. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- D. Install lamps in each luminaire.
- E. Coordinate layout and installation of luminaires and suspension system with other construction that penetrates ceilings or is supported by them.

F. Supports:

1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.

G. Ceiling-Grid-Mounted Luminaire Supports: Use grid as a support element.

1. Install ceiling support system rods or wires, independent of the ceiling suspension devices, for each luminaire. Locate not more than 6 inches from luminaire corners.
2. Support Clips: Fasten to luminaires and to ceiling grid members at or near each luminaire corner with clips that are UL listed for the application.
3. Luminaires of Sizes Less Than Ceiling Grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support luminaires independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.

H. Flush-Mounted Luminaire Support:

1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

I. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.
2. Do not attach luminaires directly to gypsum board.

J. Suspended Luminaire Support:

1. Refer to Lighting Fixture Schedule for type of hanging supports.
2. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

K. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

### 3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### 3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:

- B. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

- C. Luminaire will be considered defective if it does not pass operation tests and inspections.

D. Prepare test and inspection reports.

END OF SECTION 26 51 16