

DOCUMENT 000101 - PROJECT TITLE PAGE

1.1 PROJECT MANUAL VOLUME 1

- A. Garage Generator Room Upgrades and Domestic Water Winterization.
- B. USRDC.
- C. Washington, DC.
- D. Architect Project No. : US-WSP-192801E
- E. Architect/Engineer: WSP
- F. 1300 North 17th Street, Suite 1000, Arlington, Virginia 22209.
- G. Phone: 202-362-2800.

END OF DOCUMENT 000101

DOCUMENT 000115 - LIST OF DRAWING SHEETS

1.1 LIST OF DRAWINGS

- A. Drawings: Drawings consist of the Contract Drawings and other drawings listed on the Table of Contents page of the separately bound drawing sets titled Generator Room Upgrades and Domestic Water Winterization, dated 8-8-2025, as modified by subsequent Addenda and Contract modifications.
- B. List of Drawings: Drawings consist of the following Contract Drawings and other drawings of type indicated:
  - 1. Scope 1: Generator Room Upgrade

<b>MECHANICAL DRAWING LIST - GENERATOR ROOM UPGRADE</b>	
DRAWING NO.	DESCRIPTION
M0.01	MECHANICAL LEGENDS AND ABBREVIATIONS
M0.02	MECHANICAL SCHEDULES DETAILS AND CONTROLS
M4.00	MECHANICAL - ENLARGED VIEWS
M9.01	MECHANICAL SPECS

<b>ELECTRICAL DRAWING LIST - GENERATOR ROOM UPGRADE</b>	
DRAWING NO.	DESCRIPTION
E0.10	ELECTRICAL - LEGENDS AND ABBREVIATIONS
E0.20	ELECTRICAL - SCHEDULES
E2.02N	ELECTRICAL - BUS LEVEL - NEW WORK - NORTH
E4.00	ELECTRICAL - ENLARGED VIEWS
E7.00	ELECTRICAL - SPECS
E7.01	ELECTRICAL - SPECS
E7.02	ELECTRICAL - SPECS
E7.03	ELECTRICAL - SPECS

<b>PLUMBING DRAWING LIST - GENERATOR ROOM UPGRADE</b>	
DRAWING NO.	DESCRIPTION
P0.10	PLUMBING - COVER SHEET
P2.02N	PLUMBING - BUS LEVEL - NEW WORK - NORTH
P4.00	PLUMBING - ENLARGED VIEWS
P6.01	PLUMBING SPECIFICATIONS

2. Scope 4: Water Winterization

<b>ELECTRICAL DRAWING LIST - WATER WINTERIZATION</b>	
DRAWING NO.	DESCRIPTION
E0.10	ELECTRICAL - LEGENDS AND ABBREVIATIONS
E0.20	ELECTRICAL - SCHEDULES
E2.02N	ELECTRICAL - BUS LEVEL - NEW WORK - NORTH
E4.00	ELECTRICAL - ENLARGED VIEWS
E7.00	ELECTRICAL - SPECS
E7.01	ELECTRICAL - SPECS
E7.02	ELECTRICAL - SPECS
E7.03	ELECTRICAL - SPECS

<b>PLUMBING DRAWING LIST - WATER WINTERIZATION</b>	
DRAWING NO.	DESCRIPTION
P0.001-A	PLUMBING - LEGENDS & ABBREVIATIONS
P2.00N-4	PLUMBING - UPPER TRACK LEVEL - NEW WORK - NORTH
P2.00S-4	PLUMBING - UPPER TRACK LEVEL - NEW WORK - SOUTH
P2.02N-4	PLUMBING - BUS LEVEL - NEW WORK - NORTH
P2.02S-4	PLUMBING - BUS LEVEL - NEW WORK - SOUTH
P2.03N-4	PLUMBING - MEZZANINE LEVEL - NEW WORK - NORTH
P2.04N-4	PLUMBING - FIRST LEVEL - NEW WORK - NORTH
P2.05N-4	PLUMBING - SECOND LEVEL - NEW WORK - NORTH
P2.06N-4	PLUMBING - THIRD LEVEL - NEW WORK - NORTH
P5.01-4	PLUMBING DOMESTIC WATER DIAGRAM
P6.01-4	PLUMBING SPECIFICATIONS
P6.02-4	PLUMBING SPECIFICATIONS
P6.03-4	PLUMBING SPECIFICATIONS
P6.04-4	PLUMBING SPECIFICATIONS
P6.05-4	PLUMBING SPECIFICATIONS

END OF DOCUMENT 000115

## DOCUMENT 002600 - PROCUREMENT SUBSTITUTION PROCEDURES

### 1.1 DEFINITIONS

- A. Procurement Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Procurement and Contracting Documents, submitted prior to receipt of bids.
- B. Substitution Requests: Requests for changes in products, materials, equipment, and methods of construction from those indicated in the Contract Documents, submitted following Contract award. See Section 012500 "Substitution Procedures" for conditions under which Substitution requests will be considered following Contract award.

### 1.2 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.

### 1.3 PROCUREMENT SUBSTITUTIONS

- A. Procurement Substitutions, General: By submitting a bid, the Bidder represents that its bid is based on materials and equipment described in the Procurement and Contracting Documents, including Addenda. Bidders are encouraged to request approval of qualifying substitute materials and equipment when the Specifications Sections list materials and equipment by product or manufacturer name.
- B. Procurement Substitution Requests will be received and considered by Owner when the following conditions are satisfied, as determined by Architect; otherwise, requests will be returned without action:
  - 1. Extensive revisions to the Contract Documents are not required.
  - 2. Proposed changes are in keeping with the general intent of the Contract Documents, including the level of quality of the Work represented by the requirements therein.
  - 3. The request is fully documented and properly submitted.

### 1.4 SUBMITTALS

- A. Procurement Substitution Request: Submit to Architect. Procurement Substitution Request must be made in writing by prime contract Bidder only in compliance with the following requirements:
  - 1. Requests for substitution of materials and equipment will be considered if received no later than 10 days prior to date of bid opening.
  - 2. Submittal Format: Submit three copies of each written Procurement Substitution Request, using form bound in Project Manual or CSI Substitution Request Form 1.5C.

3. Submittal Format: Submit Procurement Substitution Request, using format provided on Project Web site.
  - a. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specifications Sections and drawing numbers.
  - b. Provide complete documentation on both the product specified and the proposed substitute, including the following information as appropriate:
    - 1) Point-by-point comparison of specified and proposed substitute product data, fabrication drawings, and installation procedures.
    - 2) Copies of current, independent third-party test data of salient product or system characteristics.
    - 3) Samples where applicable or when requested by Architect.
    - 4) Detailed comparison of significant qualities of the proposed substitute with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
    - 5) Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
    - 6) Research reports, where applicable, evidencing compliance with building code in effect for Project, from ICC-ES.
    - 7) Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, which will become necessary to accommodate the proposed substitute.
  - c. Provide certification by manufacturer that the substitute proposed is equal to or superior to that required by the Procurement and Contracting Documents, and that its in-place performance will be equal to or superior to the product or equipment specified in the application indicated.
  - d. Bidder, in submitting the Procurement Substitution Request, waives the right to additional payment or an extension of Contract Time because of the failure of the substitute to perform as represented in the Procurement Substitution Request.

B. Architect's Action:

1. Architect may request additional information or documentation necessary for evaluation of the Procurement Substitution Request. Architect will notify all bidders of acceptance of the proposed substitute by means of an Addendum to the Procurement and Contracting Documents.

- C. Architect's approval of a substitute during bidding does not relieve Contractor of the responsibility to submit required shop drawings and to comply with all other requirements of the Contract Documents.

END OF DOCUMENT 002600

DOCUMENT 003143 – TRADE PERMIT APPLICATION

1.1 PERMIT APPLICATION INFORMATION

- A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of the Bidders' own investigations. This Document and its attachments are not part of the Contract Documents.
- B. Permit Application: Owner will Complete building permit application and file with authorities having jurisdiction.
- C. Trade Permit Application: Contractor will Complete trade permit applications and file with authorities having jurisdiction.

END OF DOCUMENT 003143

DOCUMENT 004373 - PROPOSED SCHEDULE OF VALUES FORM

1.1 BID FORM SUPPLEMENT

- A. A completed Proposed Schedule of Values form is required to be attached to the Bid Form.

1.2 PROPOSED SCHEDULE OF VALUES FORM

- A. Proposed Schedule of Values Form: Provide a breakdown of the bid amount, including alternates, in enough detail to facilitate continued evaluation of bid. Coordinate with the Project Manual table of contents. Provide multiple line items for principal material and subcontract amounts in excess of five percent of the Contract Sum.
- B. Arrange schedule of values consistent with format of AIA Document G703.
  - 1. Copies of AIA standard forms may be obtained from the American Institute of Architects; <http://www.aia.org/contractdocs/purchase/index.htm>; [docspurchases@aia.org](mailto:docspurchases@aia.org); (800) 942-7732.

END OF DOCUMENT 004373

## SECTION 011000 - SUMMARY

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Work by Owner.
5. Work under separate contracts.
6. Future work.
7. Purchase contracts.
8. Owner-furnished products.
9. Contractor-furnished, Owner-installed products.
10. Access to site.
11. Coordination with occupants.
12. Work restrictions.
13. Specification and drawing conventions.
14. Miscellaneous provisions.

- B. Related Requirements:

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

#### 1.3 PROJECT INFORMATION

- A. Project Identification: Generator Room Upgrades and Domestic Water Winterization.

1. Project Location: 102 H St NE, Washington, DC 20002.

- A. Owner: USRC 750 First Street, NE, Suite 1010, Washington, DC 20002.

1. Owner's Representative: John Landry.

- B. Architect/Engineer: WSP 1300 North 17th Street, Suite 1000, Arlington, VA 22209.

- C. Project Mechanical/Electrical Coordinator for Multiple Contracts:

1. General Contractor shall act as mechanical/electrical/plumbing/fire protection coordinator.
- D. Project Web Site: A project Web site administered by Contractor will be used for purposes of managing communication and documents during the construction stage.
  1. See Section 013100 "Project Management and Coordination." for requirements for establishing, administering and using the Project Web site.

#### 1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
  1. The project provides for upgrades to the garage emergency generator system and winterization of the garage domestic water system.
- B. Type of Contract:
  1. Project will be constructed under a single prime contract.

#### 1.5 WORK UNDER SEPARATE CONTRACTS

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

#### 1.6 FUTURE WORK

- A. The Contract Documents include requirements that will allow Owner to carry out future work following completion of this Project; provide for the following future work:
  1. Garage Fire Alarm System replacement.

#### 1.7 PURCHASE CONTRACTS

- A. General: Owner has negotiated purchase contracts with suppliers of material and equipment to be incorporated into the Work. Owner will assign these purchase contracts to Contractor. Include costs for purchasing, receiving, handling, storage if required, and installation of material and equipment in the Contract Sum, unless otherwise indicated.
  1. Contractor's responsibilities are same as if Contractor had negotiated purchase contracts, including responsibility to renegotiate purchase and to execute final purchasing agreements.

## 1.8 ACCESS TO SITE

- A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project.
- B. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- C. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
  - 1. Limits: Confine construction operations to Generator room and area of work for domestic water winterization as designated by the owner.
  - 2. Driveways, Walkways and Entrances: Keep driveways parking garage, loading areas, and entrances serving premises clear and available to the Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
    - a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
    - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- D. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

## 1.9 COORDINATION WITH OCCUPANTS

- A. Full Owner Occupancy: Owner will occupy site and existing building(s) during entire construction period. Cooperate with 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. Maintain existing exits unless otherwise indicated.
  - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
  - 2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

## 1.10 WORK RESTRICTIONS

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

- B. On-Site Work Hours: Limit work in the existing building to normal business working hours of 6 a.m. to 6 p.m., Monday through Friday, unless otherwise indicated.
  - 1. Weekend Hours: 6 a.m. to 6 p.m.
  - 2. Hours for Utility Shutdowns: 10 p.m. – 6 a.m.
  - 3. Hours for noisy activity: 6 a.m. to 6 p.m.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
  - 1. Notify Owner not less than five days in advance of proposed utility interruptions.
  - 2. Obtain Owner's written permission before proceeding with utility interruptions.
- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
  - 1. Notify Owner not less than two days in advance of proposed disruptive operations.
  - 2. Obtain Owner's written permission before proceeding with disruptive operations.
- E. Controlled Substances: Use of tobacco products and other controlled substances within the existing building is not permitted.
- F. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.
- G. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.
  - 1. Maintain list of approved screened personnel with Owner's representative.

#### 1.11 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
  - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
  - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

## SECTION 012500 - SUBSTITUTION PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

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

#### 1.3 DEFINITIONS

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

#### 1.4 ACTION SUBMITTALS

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Substitution Request Form: Use CSI Form 13.1A.
  - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
    - b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.

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

## 1.5 QUALITY ASSURANCE

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

## 1.6 PROCEDURES

- A. 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 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. Substitution request is fully documented and properly submitted.
    - c. Requested substitution will not adversely affect Contractor's construction schedule.
    - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
    - e. Requested substitution is compatible with other portions of the Work.
    - f. Requested substitution has been coordinated with other portions of the Work.
    - g. Requested substitution provides specified warranty.
    - h. 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 60 days after the Notice of Award. Requests received after that time may be considered or rejected at discretion of Architect.
  - 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
    - a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
    - b. Requested substitution does not require extensive revisions to the Contract Documents.
    - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.

- d. The substitution request is fully documented and properly submitted.
- e. Requested substitution will not adversely affect Contractor's construction schedule.
- f. Requested substitution has received necessary approvals of authorities having jurisdiction.
- g. Requested substitution is compatible with other portions of the Work.
- h. Requested substitution has been coordinated with other portions of the Work.
- i. Requested substitution provides specified warranty.
- j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

## SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
  - 1. General coordination procedures.
  - 2. Coordination drawings.
  - 3. Requests for Information (RFIs).
  - 4. Project Web site.
  - 5. Project meetings.
- B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.
- C. Related Requirements:
  - 1. Section 013200 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
  - 2. Section 017300 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
  - 3. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.
  - 4. Section 019113 "General Commissioning Requirements" for coordinating the Work with Owner's Commissioning Authority.

#### 1.3 DEFINITIONS

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

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A. Include the following information in tabular form:
  - 1. Name, address, and telephone number of entity performing subcontract or supplying products.

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

### 1.5 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
1. Schedule construction operations in sequence are required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
  3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections, that depend on each other for proper installation, connection, and operation.
1. Schedule construction operations in sequence are required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  2. Coordinate installation of different components with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
  3. Make adequate provisions to accommodate items scheduled for later installation.
- C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

E. 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. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
  - c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
  - d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
  - e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
  - f. Indicate required installation sequences.
  - g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

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

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
  2. Plenum Space: Indicate sub framing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
  3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
  4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
  5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
  6. Mechanical and Plumbing Work: Show the following:
    - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
    - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
    - c. Fire-rated enclosures around ductwork.
  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. Fire-Protection System: Show the following:
    - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
  9. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will inform Contractor, who shall make changes as directed and resubmit.
  10. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 013300 "Submittal Procedures."
- C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:

1. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
2. File Preparation Format: DWG, AUTOCAD 2025, operating in Microsoft Windows operating system.
3. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format and Portable Data File (PDF) format.
4. BIM File Incorporation: Develop and incorporate coordination drawing files into Building Information Model established for Project.
  - a. Perform three-dimensional component conflict analysis as required as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.
5. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
  - a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
  - b. Digital Data Software Program: Drawings are available in REVIT and AutoCAD in MS Windows OS.
  - c. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.

#### 1.7 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
  1. 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: Software-generated form with substantially the same content as indicated above, acceptable to Architect.
  1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- D. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow seven working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
  1. The following Contractor-generated RFIs will be returned without action:
    - a. Requests for approval of submittals.
    - b. Requests for approval of substitutions.
    - c. Requests for approval of Contractor's means and methods.
    - d. Requests for coordination information already indicated in the Contract Documents.
    - e. Requests for adjustments in the Contract Time or the Contract Sum.
    - f. Requests for interpretation of Architect's actions on submittals.
    - g. Incomplete RFIs or inaccurately prepared RFIs.
  2. 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 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. Use software log that is part of Project Web site. Include the following:
  1. Project name.
  2. Name and address of Contractor.
  3. Name and address of Architect.
  4. RFI number including RFIs that were returned without action or withdrawn.
  5. RFI description.
  6. Date the RFI was submitted.
  7. Date Architect's response was received.
- F. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within 7 days if Contractor disagrees with response.

1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

## 1.8 PROJECT WEB SITE

- A. Provide, administer, and use an online project management Web site for purposes of hosting and managing project communication and documentation until Final Completion. Project Web site shall include the following functions:
  1. Project directory.
  2. Project correspondence.
  3. Meeting minutes.
  4. Contract modifications forms and logs.
  5. RFI forms and logs.
  6. Task and issue management.
  7. Photo documentation.
  8. Schedule and calendar management.
  9. Submittals forms and logs.
  10. Payment application forms.
  11. Drawing and specification document hosting, viewing, and updating.
  12. Online document collaboration.
  13. Reminder and tracking functions.
  14. Archiving functions.
- B. Provide access to the project Web site user licenses for use of the Owner, Architect, and Architect's consultants. Provide software training as requested for Project Web site users.
- C. On completion of Project, provide one complete archive copy of Project Web site files to Owner and to Architect in a digital storage format acceptable to Architect.
- D. Provide a Project Web site software package under their current published licensing agreements.
- E. Contractor, subcontractors, and other parties granted access by Contractor to Project Web site shall execute a data licensing agreement in the form of Agreement acceptable to Owner and Architect.

## 1.9 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 **three** days of the meeting.
- B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
1. Conduct the conference to review responsibilities and personnel assignments.
  2. Attendees: Authorized representatives of Owner[, Owner's Commissioning Authority,] [, Construction Manager,] Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  3. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Tentative construction schedule.
    - b. Phasing.
    - c. Critical work sequencing and long-lead items.
    - d. Designation of key personnel and their duties.
    - e. Lines of communications.
    - f. Procedures for processing field decisions and Change Orders.
    - g. Procedures for RFIs.
    - h. Procedures for testing and inspecting.
    - i. Procedures for processing Applications for Payment.
    - j. Distribution of the Contract Documents.
    - k. Submittal procedures.
    - l. Sustainable design requirements.
    - m. Preparation of record documents.
    - n. Use of the premises and existing building.
    - o. Work restrictions.
    - p. Working hours.
    - q. Owner's occupancy requirements.
    - r. Responsibility for temporary facilities and controls.
    - s. Procedures for moisture and mold control.
    - t. Procedures for disruptions and shutdowns.
    - u. Construction waste management and recycling.
    - v. Parking availability.
    - w. Office, work, and storage areas.
    - x. Equipment deliveries and priorities.
    - y. First aid.
    - z. Security.
    - aa. Progress cleaning.
  4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect and Owner of scheduled meeting dates.
  2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
    - a. Contract Documents.
    - b. Options.
    - c. Related RFIs.
    - d. Related Change Orders.
    - e. Purchases.
    - f. Deliveries.
    - g. Submittals.
    - h. Sustainable design requirements.
    - i. Review of mockups.
    - j. Possible conflicts.
    - k. Compatibility requirements.
    - l. Time schedules.
    - m. Weather limitations.
    - n. Manufacturer's written instructions.
    - o. Warranty requirements.
    - p. Compatibility of materials.
    - q. Acceptability of substrates.
    - r. Temporary facilities and controls.
    - s. Space and access limitations.
    - t. Regulations of authorities having jurisdiction.
    - u. Testing and inspecting requirements.
    - v. Installation procedures.
    - w. Coordination with other work.
    - x. Required performance results.
    - y. Protection of adjacent work.
    - z. Protection of construction and personnel.
  3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
  4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
  5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 30 days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
  2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned

parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.

3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
  - a. Preparation of record documents.
  - b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
  - c. Submittal of written warranties.
  - d. Requirements for completing sustainable design documentation.
  - e. Requirements for preparing operations and maintenance data.
  - f. Requirements for delivery of material samples, attic stock, and spare parts.
  - g. Requirements for demonstration and training.
  - h. Preparation of Contractor's punch list.
  - i. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
  - j. Submittal procedures.
  - k. Coordination of separate contracts.
  - l. Owner's partial occupancy requirements.
  - m. Installation of Owner's furniture, fixtures, and equipment.
  - n. Responsibility for removing temporary facilities and controls.
4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Conduct progress meetings at biweekly intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. 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 meeting shall be familiar with the Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
  - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    - 1) Review schedule for next period.
  - b. Review present and future needs of each entity present, including the following:
    - 1) Interface requirements.
    - 2) Sequence of operations.
    - 3) Resolution of BIM component conflicts.
    - 4) Status of submittals.

- 5) Status of sustainable design documentation.
  - 6) Deliveries.
  - 7) Off-site fabrication.
  - 8) Access.
  - 9) Site utilization.
  - 10) Temporary facilities and controls.
  - 11) Progress cleaning.
  - 12) Quality and work standards.
  - 13) Status of correction of deficient items.
  - 14) Field observations.
  - 15) Status of RFIs.
  - 16) Status of proposal requests.
  - 17) Pending changes.
  - 18) Status of Change Orders.
  - 19) Pending claims and disputes.
  - 20) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
    - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- F. Coordination Meetings: Conduct Project coordination meetings at biweekly 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) Resolution of BIM component conflicts.
  - 4) Status of submittals.
  - 5) Deliveries.
  - 6) Off-site fabrication.
  - 7) Access.
  - 8) Site utilization.
  - 9) Temporary facilities and controls.
  - 10) Work hours.
  - 11) Hazards and risks.
  - 12) Progress cleaning.
  - 13) Quality and work standards.
  - 14) Change Orders.
3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

## SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Startup construction schedule.
2. Contractor's construction schedule.
3. Construction schedule updating reports.
4. Daily construction reports.
5. Material location reports.
6. Site condition reports.
7. Special reports.

- B. Related Requirements:

1. Section 011200 "Multiple Contract Summary" for preparing a combined Contractor's construction schedule.
2. Section 013300 "Submittal Procedures" for submitting schedules and reports.
3. 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. Working electronic copy of schedule file, where indicated.
  - 2. PDF electronic file.
- B. Startup construction schedule.
  - 1. Approval of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.
- C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- D. 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.
- E. Construction Schedule Updating Reports: Submit with Applications for Payment.
- F. Daily Construction Reports: Submit at weekly intervals.
- G. Material Location Reports: Submit at weekly intervals.
- H. Site Condition Reports: Submit at time of discovery of differing conditions.

- I. Special Reports: Submit at time of unusual event.
- J. Qualification Data: For scheduling consultant.

## 1.5 QUALITY ASSURANCE

- A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with capability of producing CPM reports and diagrams within 24 hours of Architect's request.
- B. 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 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, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
  - 1. Secure time commitments for performing critical elements of the Work from entities involved.
  - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

## PART 2 - PRODUCTS

### 2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.
  - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
1. Activity Duration: Define activities so no activity is longer than **20** days, unless specifically allowed by Architect.
  2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
  3. Submittal Review Time: Include review and resubmittal times indicated in Section 013300 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
  4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
  5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
  6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
  2. Work under More Than One Contract: Include a separate activity for each contract.
  3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
  4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
  5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 011000 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
  6. Work Restrictions: Show the effect of the following items on the schedule:
    - a. Coordination with existing construction.
    - b. 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.
  7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
    - a. Subcontract awards.
    - b. Submittals.
    - c. Purchases.
    - d. Mockups.
    - e. Fabrication.

- f. Sample testing.
  - g. Deliveries.
  - h. Installation.
  - i. Tests and inspections.
  - j. Adjusting.
  - k. Curing.
  - l. Building flush-out.
  - m. Startup and placement into final use and operation.
8. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
- a. Structural completion.
  - b. Temporary enclosure and space conditioning.
  - c. Permanent space enclosure.
  - d. Completion of mechanical installation.
  - e. Completion of electrical installation.
  - f. Substantial Completion.
9. Other Constraints:
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion.
- E. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.
- F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
- 1. Unresolved issues.
  - 2. Unanswered Requests for Information.
  - 3. Rejected or unreturned submittals.
  - 4. Notations on returned submittals.
  - 5. Pending modifications affecting the Work and Contract Time.
- G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.
- H. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

## 2.2 STARTUP CONSTRUCTION SCHEDULE

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

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

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

## 2.4 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 weekly 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.

## 2.5 SPECIAL REPORTS

- A. **General:** Submit special reports directly to Owner within one 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:** 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 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 one week before each regularly scheduled progress meeting.
  - 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
  - 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.

3. As the Work progresses, indicate final completion percentage for each activity.
- 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 013233 - PHOTOGRAPHIC DOCUMENTATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
  - 1. Preconstruction photographs.
  - 2. Periodic construction photographs.
  - 3. Final completion construction photographs.
  - 4. Preconstruction video recordings.
  - 5. Periodic construction video recordings.
  - 6. Web-based construction photographic documentation.
- B. Related Requirements:
  - 1. Section 013300 "Submittal Procedures" for submitting photographic documentation.
  - 2. Section 017700 "Closeout Procedures" for submitting photographic documentation as project record documents at Project closeout.
  - 3. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

#### 1.3 ALLOWANCES

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

#### 1.4 UNIT PRICES

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

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- B. Digital Photographs: Submit image files within three days of taking photographs.

1. Digital Camera: Minimum sensor resolution of 8 megapixels.
2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
3. Identification: Provide the following information with each image description in file metadata tag:
  - a. Name of Project.
  - b. Name and contact information for photographer.
  - c. Name of Architect.
  - d. Name of Contractor.
  - e. Date photograph was taken.
  - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
  - g. Unique sequential identifier keyed to accompanying key plan.

## 1.6 QUALITY ASSURANCE

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

## 1.7 USAGE RIGHTS

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

## PART 2 - PRODUCTS

### 2.1 PHOTOGRAPHIC MEDIA

- A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

## PART 3 - EXECUTION

### 3.1 CONSTRUCTION PHOTOGRAPHS

- A. Photographer: Engage a qualified photographer to take construction photographs.
- B. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
  1. Maintain key plan with each set of construction photographs that identifies each photographic location.

- C. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
1. Date and Time: Include date and time in file name for each image.
  2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect.
- D. Preconstruction Photographs: Before commencement of demolition, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect.
1. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- E. Periodic Construction Photographs: Take 20 photographs weekly, with timing each month adjusted to coincide with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.
- F. Architect-Directed Construction Photographs: From time to time, Architect will instruct photographer about number and frequency of photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.
- G. Time-Lapse Sequence Construction Photographs: Take 20 photographs as indicated, to show status of construction and progress since last photographs were taken.
1. Frequency: Take photographs weekly, with timing each month adjusted to coincide with the cutoff date associated with each Application for Payment.
  2. Vantage Points: Following suggestions by Architect and Contractor, photographer to select vantage points. During each of the following construction phases, take not less than two of the required shots from same vantage point each time to create a time-lapse sequence as follows:
    - a. Exterior building enclosure.
    - b. Interior Work, through date of Substantial Completion.
- H. Final Completion Construction Photographs: Take 20 color photographs after date of Substantial Completion for submission as project record documents. Architect will inform photographer of desired vantage points.
1. Do not include date stamp.
- I. Additional Photographs: Architect may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum or in the allowance for construction photographs.
1. Three days' notice will be given, where feasible.
  2. In emergency situations, take additional photographs within 24 hours of request.
  3. Circumstances that could require additional photographs include, but are not limited to, the following:

- a. Special events planned at Project site.
- b. Immediate follow-up when on-site events result in construction damage or losses.
- c. Photographs to be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
- d. Substantial Completion of a major phase or component of the Work.
- e. Extra record photographs at time of final acceptance.

END OF SECTION 013233

## SECTION 013300 - SUBMITTAL PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
  - 1. Section 013200 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
  - 2. Section 017823 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
  - 3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
  - 4. Section 017900 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

#### 1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."
- 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. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
  3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
    - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
  4. Format: Arrange the following information in a tabular format:
    - a. Scheduled date for first submittal.
    - b. Specification Section number and title.
    - c. Submittal category: Action; informational.
    - d. Name of subcontractor.
    - e. Description of the Work covered.
    - f. Scheduled date for Architect's final release or approval.
    - g. Scheduled date of fabrication.
    - h. Scheduled dates for 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 one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.
    - a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
    - b. Digital Drawing Software Program: The Contract Drawings are available in Revit 2025 and MS Windows OS.
    - c. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.
    - d. The following digital data files will be furnished for each appropriate discipline:
      - 1) Floor plans.

- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
  3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
  4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
    - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
  2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
  3. Resubmittal Review: Allow 15 days for review of each resubmittal.
  4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
  5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
- D. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
  2. Name file with submittal number or other unique identifier, including revision identifier.
    - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).
  3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.

4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software acceptable to Owner, containing the following information:
  - a. Project name.
  - b. Date.
  - c. Name and address of Architect.
  - d. Name of Construction Manager.
  - e. Name of Contractor.
  - f. Name of firm or entity that prepared submittal.
  - g. Names of subcontractor, manufacturer, and supplier.
  - h. Category and type of submittal.
  - i. Submittal purpose and description.
  - j. Specification Section number and title.
  - k. Specification paragraph number or drawing designation and generic name for each of multiple items.
  - l. Drawing number and detail references, as appropriate.
  - m. Location(s) where product is to be installed, as appropriate.
  - n. Related physical samples submitted directly.
  - o. Indication of full or partial submittal.
  - p. Transmittal number.
  - q. Submittal and transmittal distribution record.
  - r. Other necessary identification.
  - s. Remarks.
5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
  - a. Project name.
  - b. Number and title of appropriate Specification Section.
  - c. Manufacturer name.
  - d. Product name.
- E. Options: Identify options requiring selection by Architect.
- F. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
  1. Note date and content of previous submittal.
  2. Note date and content of revision in label or title block and clearly indicate extent of revision.
  3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

- I. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

## PART 2 - PRODUCTS

### 2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
  1. Post electronic submittals as PDF electronic files directly to Project Web site specifically established for Project.
    - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
  2. 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 each submittal unless otherwise indicated. Architect will return one copy.
  4. Informational Submittals: Submit 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.
    - a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
- 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, unless submittal based on Architect's digital data drawing files is otherwise permitted.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    - a. Identification of products.
    - b. Schedules.
    - c. Compliance with specified standards.
    - d. Notation of coordination requirements.
    - e. Notation of dimensions established by field measurement.
    - f. Relationship and attachment to adjoining construction clearly indicated.
    - g. Seal and signature of professional engineer if specified.
  2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm), but no larger than 30 by 42 inches (750 by 1067 mm)].
  3. Submit Shop Drawings in the following format:
    - a. PDF electronic file.
  4. BIM File Incorporation: Develop and incorporate Shop Drawing files into Building Information Model established for Project.
    - a. Prepare Shop Drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.
    - b. Refer to Section 013100 "Project Management and Coordination" for requirements for coordination drawings.
- D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
  2. Manufacturer and product name, and model number if applicable.
  3. Number and name of room or space.
  4. Location within room or space.
  5. Submit product schedule in the following format:
    - a. PDF electronic file.
- 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. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 014000 "Quality Requirements."
- H. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 017700 "Closeout Procedures."
- I. Maintenance Data: Comply with requirements specified in Section 017823 "Operation and Maintenance Data."
- J. 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.
- K. 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.
- L. 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.
- M. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- 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. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
  - 1. Name of evaluation organization.
  - 2. Date of evaluation.
  - 3. Time period when report is in effect.
  - 4. Product and manufacturers' names.
  - 5. Description of product.
  - 6. Test procedures and results.
  - 7. Limitations of use.
- S. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- T. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- U. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- V. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

## 2.2 DELEGATED-DESIGN SERVICES

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

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.
- C. BIM File Incorporation: Incorporate delegated-design drawing and data files into Building information Model established for Project.
1. Prepare delegated-design drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.

## PART 3 - EXECUTION

### 3.1 CONTRACTOR'S REVIEW

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

### 3.2 ARCHITECT'S ACTION

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

END OF SECTION 013300

## SECTION 013516 - ALTERATION PROJECT PROCEDURES

### 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 special procedures for alteration work.

#### 1.3 DEFINITIONS

- A. Alteration Work: This term includes remodeling, renovation, repair, and maintenance work performed within existing spaces or on existing surfaces as part of the Project.
- B. Consolidate: To strengthen loose or deteriorated materials in place.
- C. Design Reference Sample: A sample that represents the Architect's prebid selection of work to be matched; it may be existing work or work specially produced for the Project.
- D. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.
- E. Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Architect.
- F. Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.
- G. Repair: To correct damage and defects, retaining existing materials, features, and finishes. This includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.
- H. Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.
- I. Replicate: To reproduce in exact detail, materials, and finish unless otherwise indicated.
- J. Reproduce: To fabricate a new item, accurate in detail to the original, and from either the same or a similar material as the original, unless otherwise indicated.
- K. Retain: To keep existing items that are not to be removed or dismantled.

- L. Strip: To remove existing finish down to base material unless otherwise indicated.

#### 1.4 COORDINATION

- A. Alteration Work Sub-schedule: A construction schedule coordinating the sequencing and scheduling of alteration work for entire Project, including each activity to be performed, and based on Contractor's Construction Schedule. Secure time commitments for performing critical construction activities from separate entities responsible for alteration work.
  - 1. Schedule construction operations in sequence required to obtain best Work results.
  - 2. Coordinate sequence of alteration work activities to accommodate the following:
    - a. Owner's continuing occupancy of portions of existing building.
    - b. Owner's partial occupancy of completed Work.
    - c. Other known work in progress.
    - d. Tests and inspections.
  - 3. Detail sequence of alteration work, with start and end dates.
  - 4. Utility Services: Indicate how long utility services will be interrupted. Coordinate shutoff, capping, and continuation of utility services.
  - 5. Use of elevator and stairs.
  - 6. Equipment Data: List gross loaded weight, axle-load distribution, and wheel-base dimension data for mobile and heavy equipment proposed for use in existing structure. Do not use such equipment without certification from Contractor's professional engineer that the structure can support the imposed loadings without damage.
- B. Pedestrian and Vehicular Circulation: Coordinate alteration work with circulation patterns within Project building(s) and site. Some work is near circulation patterns. Circulation patterns cannot be closed off entirely and in places can be only temporarily redirected around small areas of work. Plan and execute the Work accordingly.

#### 1.5 PROJECT MEETINGS FOR ALTERATION WORK

- A. Preliminary Conference for Alteration Work: Before starting alteration work, conduct conference at Project site.
  - 1. Attendees: In addition to representatives of Owner, Architect, and Contractor, testing service representative, specialists, and chemical-cleaner manufacturer(s) shall be represented at the meeting.
  - 2. Agenda: Discuss items of significance that could affect progress of alteration work, including review of the following:
    - a. Alteration Work Subschedule: Discuss and finalize; verify availability of materials, specialists' personnel, equipment, and facilities needed to make progress and avoid delays.
    - b. Fire-prevention plan.
    - c. Governing regulations.
    - d. Areas where existing construction is to remain and the required protection.
    - e. Hauling routes.

- f. Sequence of alteration work operations.
  - g. Storage, protection, and accounting for salvaged and specially fabricated items.
  - h. Existing conditions, staging, and structural loading limitations of areas where materials are stored.
  - i. Qualifications of personnel assigned to alteration work and assigned duties.
  - j. Requirements for extent and quality of work, tolerances, and required clearances.
  - k. Embedded work such as flashings and lintels, special details, collection of waste, protection of occupants and the public, and condition of other construction that affects the Work or will affect the work.
3. Reporting: Record conference results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from conference.
- B. Coordination Meetings: Conduct coordination meetings specifically for alteration work at weekly intervals. Coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
1. Attendees: In addition to representatives of Owner, Architect, and Contractor, each specialist, supplier, installer, and other entity concerned with progress or involved in planning, coordination, or performance of alteration work activities shall be represented at these meetings. All participants at conference shall be familiar with Project and authorized to conclude matters relating to alteration work.
  2. Agenda: Review and correct or approve minutes of previous coordination meeting. Review other items of significance that could affect progress of alteration work. Include topics for discussion as appropriate to status of Project.
    - a. Alteration Work Sub-schedule: Review progress since last coordination meeting. Determine whether each schedule item is on time, ahead of schedule, or behind schedule. Determine how construction behind schedule will be expedited with retention of quality; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities are completed within the Contract Time.
    - b. Schedule Updating: Revise Contractor's Alteration Work Sub-schedule after each coordination meeting where revisions to schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
    - c. Review present and future needs of each entity present, including review items listed in the "Preliminary Conference for Alteration Work" Paragraph in this article and the following:
      - 1) Interface requirements of alteration work with other Project Work.
      - 2) Status of submittals for alteration work.
      - 3) Access to alteration work locations.
      - 4) Effectiveness of fire-prevention plan.
      - 5) Quality and work standards of alteration work.
      - 6) Change Orders for alteration work.
  3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

## 1.6 INFORMATIONAL SUBMITTALS

- A. Alteration Work Sub-schedule:
  - 1. Submit alteration work sub-schedule within seven days of date established for commencement of alteration work.
- B. Preconstruction Documentation: Show preexisting conditions of adjoining construction and site improvements that are to remain, including finish surfaces, that might be misconstrued as damage caused by Contractor's alteration work operations.
- C. Alteration Work Program: Submit 30 days before work begins.
- D. Fire-Prevention Plan: Submit 30 days before work begins.

## 1.7 QUALITY ASSURANCE

- A. Specialist Qualifications: An experienced firm regularly engaged in specialty work similar in nature, materials, design, and extent to alteration work as specified in each Section and that has completed a minimum of five recent projects with a record of successful in-service performance that demonstrates the firm's qualifications to perform this work.
  - 1. Field Supervisor Qualifications: Full-time supervisors experienced in specialty work similar in nature, material, design, and extent to that indicated for this Project. Supervisors shall be on-site when specialty work begins and during its progress. Supervisors shall not be changed during Project except for causes beyond the control of the specialist firm.
    - a. Construct new mockups of required work whenever a supervisor is replaced.
- B. Title X Requirement: Each firm conducting activities that disturb painted surfaces shall be a "Lead-Safe Certified Firm" according to 40 CFR 745, Subpart E, and use only workers that are trained in lead-safe work practices.
- C. Alteration Work Program: Prepare a written plan for alteration work for whole Project, including each phase or process and protection of surrounding materials during operations. Show compliance with indicated methods and procedures specified in this and other Sections. Coordinate this whole-Project alteration work program with specific requirements of programs required in other alteration work Sections.
  - 1. Dust and Noise Control: Include locations of proposed temporary dust- and noise-control partitions and means of egress from occupied areas coordinated with continuing on-site operations and other known work in progress.
  - 2. Debris Hauling: Include plans clearly marked to show debris hauling routes, turning radii, and locations and details of temporary protective barriers.
- D. Fire-Prevention Plan: Prepare a written plan for preventing fires during the Work, including placement of fire extinguishers, fire blankets, rag buckets, and other fire-control devices during each phase or process. Coordinate plan with Owner's fire-protection equipment and

requirements. Include fire-watch personnel's training, duties, and authority to enforce fire safety.

- E. Safety and Health Standard: Comply with ANSI/ASSE A10.6.

## 1.8 STORAGE AND HANDLING OF SALVAGED MATERIALS

- A. Existing Materials to Remain: Protect construction indicated to remain against damage and soiling from construction work. Where permitted by Architect, items may be dismantled and taken to a suitable, protected storage location during construction work and reinstalled in their original locations after alteration and other construction work in the vicinity is complete.
- B. Storage Space:
  - 1. Owner will arrange for limited on-site location(s) for free storage of salvaged material. This storage space does not include security for stored material.
  - 2. Arrange for off-site locations for storage and protection of salvaged material that cannot be stored and protected on-site.

## 1.9 FIELD CONDITIONS

- A. Survey of Existing Conditions: Record existing conditions that affect the Work by use of measured drawings, preconstruction photographs and preconstruction video.
  - 1. Comply with requirements specified in Section 013233 "Photographic Documentation."
- B. Discrepancies: Notify Architect of discrepancies between existing conditions and Drawings before proceeding with removal and dismantling work.
- C. Owner's Removals: Before beginning alteration work, verify in correspondence with Owner that the following items have been removed:
  - 1. Stored Materials.
- D. Size Limitations in Existing Spaces: Materials, products, and equipment used for performing the Work and for transporting debris, materials, and products shall be of sizes that clear surfaces within existing spaces, areas, rooms, and openings, including temporary protection, by 12 inches (300 mm) or more.

## PART 2 - PRODUCTS - (Not Used)

## PART 3 - EXECUTION

### 3.1 PROTECTION

- A. Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from alteration work.

1. Use only proven protection methods, appropriate to each area and surface being protected.
2. Provide temporary barricades, barriers, and directional signage to exclude the public from areas where alteration work is being performed.
3. Erect temporary barriers to form and maintain fire-egress routes.
4. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during alteration work.
5. Contain dust and debris generated by alteration work, and prevent it from reaching the public or adjacent surfaces.
6. Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
7. Protect floors and other surfaces along hauling routes from damage, wear, and staining.
8. Provide supplemental sound-control treatment to isolate demolition work from other areas of the building.

B. Temporary Protection of Materials to Remain:

1. Protect existing materials with temporary protections and construction. Do not remove existing materials unless otherwise indicated.
2. Do not attach temporary protection to existing surfaces except as indicated as part of the alteration work program.

C. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.

D. Utility and Communications Services:

1. Notify Owner, Architect, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by alteration work before commencing operations.
2. Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for alteration work.
3. Maintain existing services unless otherwise indicated; keep in service, and protect against damage during operations. Provide temporary services during interruptions to existing utilities.

E. Existing Drains: Prior to the start of work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin work in an area until the drainage system is functioning properly.

1. Prevent solids such as adhesive or mortar residue or other debris from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from alteration work.
2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.

### 3.2 PROTECTION FROM FIRE

A. General: Follow fire-prevention plan and the following:

1. Comply with NFPA 241 requirements unless otherwise indicated.
  2. Remove and keep area free of combustibles, including rubbish, paper, waste, and chemicals, unless necessary for the immediate work.
    - a. If combustible material cannot be removed, provide fire blankets to cover such materials.
- B. Heat-Generating Equipment and Combustible Materials: Comply with the following procedures while performing work with heat-generating equipment or combustible materials, including welding, torch-cutting, soldering, brazing, removing paint with heat, or other operations where open flames or implements using high heat or combustible solvents and chemicals are anticipated:
1. Obtain Owner's approval for operations involving use of welding or other high-heat equipment. Use of open-flame equipment is not permitted. Notify Owner at least 72 hours before each occurrence, indicating location of such work.
  2. As far as practicable, restrict heat-generating equipment to shop areas or outside the building.
  3. Do not perform work with heat-generating equipment in or near rooms or in areas where flammable liquids or explosive vapors are present or thought to be present. Use a combustible gas indicator test to ensure that the area is safe.
  4. Use fireproof baffles to prevent flames, sparks, hot gases, or other high-temperature material from reaching surrounding combustible material.
  5. Prevent the spread of sparks and particles of hot metal through open windows, doors, holes, and cracks in floors, walls, ceilings, roofs, and other openings.
  6. Fire Watch: Before working with heat-generating equipment or combustible materials, station personnel to serve as a fire watch at each location where such work is performed. Fire-watch personnel shall have the authority to enforce fire safety. Station fire watch according to NFPA 51B, NFPA 241, and as follows:
    - a. Train each fire watch in the proper operation of fire-control equipment and alarms.
    - b. Prohibit fire-watch personnel from other work that would be a distraction from fire-watch duties.
    - c. Cease work with heat-generating equipment whenever fire-watch personnel are not present.
    - d. Have fire-watch personnel perform final fire-safety inspection each day beginning no sooner than 30 minutes after conclusion of work in each area to detect hidden or smoldering fires and to ensure that proper fire prevention is maintained.
    - e. Maintain fire-watch personnel at each area of Project site until 60 minutes after conclusion of daily work.
- C. Fire-Control Devices: Provide and maintain fire extinguishers, fire blankets, and rag buckets for disposal of rags with combustible liquids. Maintain each as suitable for the type of fire risk in each work area. Ensure that nearby personnel and the fire-watch personnel are trained in fire-extinguisher and blanket use.
- D. Sprinklers: Where sprinkler protection exists and is functional, maintain it without interruption while operations are being performed. If operations are performed close to sprinklers, shield them temporarily with guards.

1. Remove temporary guards at the end of work shifts, whenever operations are paused, and when nearby work is complete.

### 3.3 PROTECTION DURING APPLICATION OF CHEMICALS

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

### 3.4 GENERAL ALTERATION WORK

- A. Have specialty work performed only by qualified specialists.
- B. Ensure that supervisory personnel are present when work begins and during its progress.
- C. Record existing work before each procedure (preconstruction), and record progress during the work. Use digital preconstruction documentation photographs or video recordings. Comply with requirements in Section 013233 "Photographic Documentation."
- D. Perform surveys of Project site as the Work progresses to detect hazards resulting from alterations.
- E. Notify Architect of visible changes in the integrity of material or components whether from environmental causes including biological attack, UV degradation, freezing, or thawing or from structural defects including cracks, movement, or distortion.
  1. Do not proceed with the work in question until directed by Architect.

END OF SECTION 013516

## SECTION 014000 - QUALITY REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with the Contract Document requirements.
  - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
  - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
  - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
  - 4. Specific test and inspection requirements are not specified in this Section.
- C. Related Requirements:
  - 1. Section 012100 "Allowances" for testing and inspecting allowances.

#### 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]** <Insert number> 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. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
  - 1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
  - 2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.
- D. 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.
- E. 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 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.

- B. **Quality-Control Personnel Qualifications:** Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
  - 1. **Project quality-control manager may also serve as Project superintendent.**
- C. **Submittal Procedure:** Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. **Testing and Inspection:** In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
  - 1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
  - 2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
  - 3. Owner-performed tests and inspections indicated in the Contract Documents.
- E. **Continuous Inspection of Workmanship:** Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. **Monitoring and Documentation:** Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

## 1.7 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.

1.8 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
  - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
  - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
  - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
  - 1. Contractor responsibilities include the following:
    - a. Provide test specimens representative of proposed products and construction.
    - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
  - 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.

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

#### 1.10 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner and as follows:

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

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 ACCEPTABLE TESTING AGENCIES

- A. To be provided by the architect or owner as required.

### 3.2 TEST AND INSPECTION LOG

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

### 3.3 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": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.
- H. "Provide": Furnish and install, complete and ready for the intended use.
- I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

#### 1.3 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 Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
  - 1. AABC - Associated Air Balance Council; [www.aabc.com](http://www.aabc.com)
  - 2. AAMA - American Architectural Manufacturers Association; [www.aamanet.org](http://www.aamanet.org).
  - 3. AAPFCO - Association of American Plant Food Control Officials; [www.aapfco.org](http://www.aapfco.org).
  - 4. AASHTO - American Association of State Highway and Transportation Officials; [www.transportation.org](http://www.transportation.org).
  - 5. AATCC - American Association of Textile Chemists and Colorists; [www.aatcc.org](http://www.aatcc.org).
  - 6. ABMA - American Bearing Manufacturers Association; [www.americanbearings.org](http://www.americanbearings.org).
  - 7. ABMA - American Boiler Manufacturers Association; [www.abma.com](http://www.abma.com).
  - 8. ACI - American Concrete Institute; (Formerly: ACI International); [www.abma.com](http://www.abma.com).
  - 9. ACPA - American Concrete Pipe Association; [www.concrete-pipe.org](http://www.concrete-pipe.org).
  - 10. AEIC - Association of Edison Illuminating Companies, Inc. (The); [www.aeic.org](http://www.aeic.org).
  - 11. AF&PA - American Forest & Paper Association; [www.afandpa.org](http://www.afandpa.org).
  - 12. AGA - American Gas Association; [www.aga.org](http://www.aga.org).
  - 13. AHAM - Association of Home Appliance Manufacturers; [www.aham.org](http://www.aham.org).
  - 14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); [www.ahrinet.org](http://www.ahrinet.org).
  - 15. AI - Asphalt Institute; [www.asphaltinstitute.org](http://www.asphaltinstitute.org).
  - 16. AIA - American Institute of Architects (The); [www.aia.org](http://www.aia.org).
  - 17. AISC - American Institute of Steel Construction; [www.aisc.org](http://www.aisc.org).
  - 18. AISI - American Iron and Steel Institute; [www.steel.org](http://www.steel.org).
  - 19. AITC - American Institute of Timber Construction; [www.aitc-glulam.org](http://www.aitc-glulam.org).
  - 20. AMCA - Air Movement and Control Association International, Inc.; [www.amca.org](http://www.amca.org).
  - 21. ANSI - American National Standards Institute; [www.ansi.org](http://www.ansi.org).
  - 22. AOSA - Association of Official Seed Analysts, Inc.; [www.aosaseed.com](http://www.aosaseed.com).
  - 23. APA - APA - The Engineered Wood Association; [www.apawood.org](http://www.apawood.org).
  - 24. APA - Architectural Precast Association; [www.archprecast.org](http://www.archprecast.org).
  - 25. API - American Petroleum Institute; [www.api.org](http://www.api.org).
  - 26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
  - 27. ARI - American Refrigeration Institute; (See AHRI).

28. ARMA - Asphalt Roofing Manufacturers Association; [www.asphaltroofing.org](http://www.asphaltroofing.org).
29. ASCE - American Society of Civil Engineers; [www.asce.org](http://www.asce.org).
30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; [www.ashrae.org](http://www.ashrae.org).
32. ASME - ASME International; (American Society of Mechanical Engineers); [www.asme.org](http://www.asme.org).
33. ASSE - American Society of Safety Engineers (The); [www.asse.org](http://www.asse.org).
34. ASSE - American Society of Sanitary Engineering; [www.asse-plumbing.org](http://www.asse-plumbing.org).
35. ASTM - ASTM International; [www.astm.org](http://www.astm.org).
36. ATIS - Alliance for Telecommunications Industry Solutions; [www.atis.org](http://www.atis.org).
37. AWEA - American Wind Energy Association; [www.awea.org](http://www.awea.org).
38. AWI - Architectural Woodwork Institute; [www.awinet.org](http://www.awinet.org).
39. AWMAC - Architectural Woodwork Manufacturers Association of Canada; [www.awmac.com](http://www.awmac.com).
40. AWPA - American Wood Protection Association; [www.awpa.com](http://www.awpa.com).
41. AWS - American Welding Society; [www.aws.org](http://www.aws.org).
42. AWWA - American Water Works Association; [www.awwa.org](http://www.awwa.org).
43. BHMA - Builders Hardware Manufacturers Association; [www.buildershardware.com](http://www.buildershardware.com).
44. BIA - Brick Industry Association (The); [www.gobrick.com](http://www.gobrick.com).
45. BICSI - BICSI, Inc.; [www.bicsi.org](http://www.bicsi.org).
46. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); [www.bifma.org](http://www.bifma.org).
47. BISSC - Baking Industry Sanitation Standards Committee; [www.bissc.org](http://www.bissc.org).
48. BWF - Badminton World Federation; (Formerly: International Badminton Federation); [www.bissc.org](http://www.bissc.org).
49. CDA - Copper Development Association; [www.copper.org](http://www.copper.org).
50. CEA - Canadian Electricity Association; [www.electricity.ca](http://www.electricity.ca).
51. CEA - Consumer Electronics Association; [www.ce.org](http://www.ce.org).
52. CFFA - Chemical Fabrics and Film Association, Inc.; [www.chemicalfabricsandfilm.com](http://www.chemicalfabricsandfilm.com).
53. CFSEI - Cold-Formed Steel Engineers Institute; [www.cfsei.org](http://www.cfsei.org).
54. CGA - Compressed Gas Association; [www.cganet.com](http://www.cganet.com).
55. CIMA - Cellulose Insulation Manufacturers Association; [www.cellulose.org](http://www.cellulose.org).
56. CISCA - Ceilings & Interior Systems Construction Association; [www.cisca.org](http://www.cisca.org).
57. CISPI - Cast Iron Soil Pipe Institute; [www.cispi.org](http://www.cispi.org).
58. CLFMI - Chain Link Fence Manufacturers Institute; [www.chainlinkinfo.org](http://www.chainlinkinfo.org).
59. CPA - Composite Panel Association; [www.pbmdf.com](http://www.pbmdf.com).
60. CRI - Carpet and Rug Institute (The); [www.carpet-rug.org](http://www.carpet-rug.org).
61. CRRC - Cool Roof Rating Council; [www.coolroofs.org](http://www.coolroofs.org).
62. CRSI - Concrete Reinforcing Steel Institute; [www.crsi.org](http://www.crsi.org).
63. CSA - Canadian Standards Association; [www.csa.ca](http://www.csa.ca).
64. CSA - CSA International; (Formerly: IAS - International Approval Services); [www.csa-international.org](http://www.csa-international.org).
65. CSI - Construction Specifications Institute (The); [www.csinet.org](http://www.csinet.org).
66. CSSB - Cedar Shake & Shingle Bureau; [www.cedarbureau.org](http://www.cedarbureau.org).
67. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); [www.cti.org](http://www.cti.org).
68. CWC - Composite Wood Council; (See CPA).
69. DASMA - Door and Access Systems Manufacturers Association; [www.dasma.com](http://www.dasma.com).
70. DHI - Door and Hardware Institute; [www.dhi.org](http://www.dhi.org).
71. ECA - Electronic Components Association; (See ECIA).

72. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
73. ECIA - Electronic Components Industry Association; [www.eciaonline.org](http://www.eciaonline.org).
74. EIA - Electronic Industries Alliance; (See TIA).
75. EIMA - EIFS Industry Members Association; [www.eima.com](http://www.eima.com).
76. EJMA - Expansion Joint Manufacturers Association, Inc.; [www.ejma.org](http://www.ejma.org).
77. ESD - ESD Association; (Electrostatic Discharge Association); [www.esda.org](http://www.esda.org).
78. ESTA - Entertainment Services and Technology Association; (See PLASA).
79. EVO - Efficiency Valuation Organization; [www.evo-world.org](http://www.evo-world.org).
80. FCI - Fluid Controls Institute; [www.fluidcontrolsinstitute.org](http://www.fluidcontrolsinstitute.org).
81. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); [www.fiba.com](http://www.fiba.com).
82. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); [www.fivb.org](http://www.fivb.org).
83. FM Approvals - FM Approvals LLC; [www.fmglobal.com](http://www.fmglobal.com).
84. FM Global - FM Global; (Formerly: FMG - FM Global); [www.fmglobal.com](http://www.fmglobal.com).
85. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; [www.floridarroof.com](http://www.floridarroof.com).
86. FSA - Fluid Sealing Association; [www.fluidsealing.com](http://www.fluidsealing.com).
87. FSC - Forest Stewardship Council U.S.; [www.fscus.org](http://www.fscus.org).
88. GA - Gypsum Association; [www.gypsum.org](http://www.gypsum.org).
89. GANA - Glass Association of North America; [www.glasswebsite.com](http://www.glasswebsite.com).
90. GS - Green Seal; [www.greenseal.org](http://www.greenseal.org).
91. HI - Hydraulic Institute; [www.pumps.org](http://www.pumps.org).
92. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
93. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
94. HPVA - Hardwood Plywood & Veneer Association; [www.hpva.org](http://www.hpva.org).
95. HPW - H. P. White Laboratory, Inc.; [www.hpwhite.com](http://www.hpwhite.com).
96. IAPSC - International Association of Professional Security Consultants; [www.iapsc.org](http://www.iapsc.org).
97. IAS - International Accreditation Service; [www.iasonline.org](http://www.iasonline.org).
98. IAS - International Approval Services; (See CSA).
99. ICBO - International Conference of Building Officials; (See ICC).
100. ICC - International Code Council; [www.iccsafe.org](http://www.iccsafe.org).
101. ICEA - Insulated Cable Engineers Association, Inc.; [www.icea.net](http://www.icea.net).
102. ICPA - International Cast Polymer Alliance; [www.icpa-hq.org](http://www.icpa-hq.org).
103. ICRI - International Concrete Repair Institute, Inc.; [www.icri.org](http://www.icri.org).
104. IEC - International Electrotechnical Commission; [www.iec.ch](http://www.iec.ch).
105. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); [www.ieee.org](http://www.ieee.org).
106. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); [www.ies.org](http://www.ies.org).
107. IESNA - Illuminating Engineering Society of North America; (See IES).
108. IEST - Institute of Environmental Sciences and Technology; [www.iest.org](http://www.iest.org).
109. IGMA - Insulating Glass Manufacturers Alliance; [www.igmaonline.org](http://www.igmaonline.org).
110. IGSHPA - International Ground Source Heat Pump Association; [www.igshpa.okstate.edu](http://www.igshpa.okstate.edu).
111. ILI - Indiana Limestone Institute of America, Inc.; [www.iliai.com](http://www.iliai.com).
112. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); [www.intertek.com](http://www.intertek.com).
113. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); [www.isa.org](http://www.isa.org).
114. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).

115. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); [www.isfanow.org](http://www.isfanow.org).
116. ISO - International Organization for Standardization; [www.iso.org](http://www.iso.org).
117. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
118. ITU - International Telecommunication Union; [www.itu.int/home](http://www.itu.int/home).
119. KCMA - Kitchen Cabinet Manufacturers Association; [www.kcma.org](http://www.kcma.org).
120. LMA - Laminating Materials Association; (See CPA).
121. LPI - Lightning Protection Institute; [www.lightning.org](http://www.lightning.org).
122. MBMA - Metal Building Manufacturers Association; [www.mbma.com](http://www.mbma.com).
123. MCA - Metal Construction Association; [www.metalconstruction.org](http://www.metalconstruction.org).
124. MFMA - Maple Flooring Manufacturers Association, Inc.; [www.maplefloor.org](http://www.maplefloor.org).
125. MFMA - Metal Framing Manufacturers Association, Inc.; [www.metalframingmfg.org](http://www.metalframingmfg.org).
126. MHIA - Material Handling Industry of America; [www.mhia.org](http://www.mhia.org).
127. MIA - Marble Institute of America; [www.marble-institute.com](http://www.marble-institute.com).
128. MMPA - Moulding & Millwork Producers Association; [www.wmmpa.com](http://www.wmmpa.com).
129. MPI - Master Painters Institute; [www.paintinfo.com](http://www.paintinfo.com).
130. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; [www.mss-hq.org](http://www.mss-hq.org).
131. NAAMM - National Association of Architectural Metal Manufacturers; [www.naamm.org](http://www.naamm.org).
132. NACE - NACE International; (National Association of Corrosion Engineers International); [www.nace.org](http://www.nace.org).
133. NADCA - National Air Duct Cleaners Association; [www.nadca.com](http://www.nadca.com).
134. NAIMA - North American Insulation Manufacturers Association; [www.naima.org](http://www.naima.org).
135. NBGQA - National Building Granite Quarries Association, Inc.; [www.nbgqa.com](http://www.nbgqa.com).
136. NBI - New Buildings Institute; [www.newbuildings.org](http://www.newbuildings.org).
137. NCAA - National Collegiate Athletic Association (The); [www.ncaa.org](http://www.ncaa.org).
138. NCMA - National Concrete Masonry Association; [www.ncma.org](http://www.ncma.org).
139. NEBB - National Environmental Balancing Bureau; [www.nebb.org](http://www.nebb.org).
140. NECA - National Electrical Contractors Association; [www.necanet.org](http://www.necanet.org).
141. NeLMA - Northeastern Lumber Manufacturers Association; [www.nelma.org](http://www.nelma.org).
142. NEMA - National Electrical Manufacturers Association; [www.nema.org](http://www.nema.org).
143. NETA - InterNational Electrical Testing Association; [www.netaworld.org](http://www.netaworld.org).
144. NFHS - National Federation of State High School Associations; [www.nfhs.org](http://www.nfhs.org).
145. NFPA - National Fire Protection Association; [www.nfpa.org](http://www.nfpa.org).
146. NFPA - NFPA International; (See NFPA).
147. NFRC - National Fenestration Rating Council; [www.nfrc.org](http://www.nfrc.org).
148. NHLA - National Hardwood Lumber Association; [www.nhla.com](http://www.nhla.com).
149. NLGA - National Lumber Grades Authority; [www.nlga.org](http://www.nlga.org).
150. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
151. NOMMA - National Ornamental & Miscellaneous Metals Association; [www.nomma.org](http://www.nomma.org).
152. NRCA - National Roofing Contractors Association; [www.nrca.net](http://www.nrca.net).
153. NRMCA - National Ready Mixed Concrete Association; [www.nrmca.org](http://www.nrmca.org).
154. NSF - NSF International; [www.nsf.org](http://www.nsf.org).
155. NSPE - National Society of Professional Engineers; [www.nspe.org](http://www.nspe.org).
156. NSSGA - National Stone, Sand & Gravel Association; [www.nssga.org](http://www.nssga.org).
157. NTMA - National Terrazzo & Mosaic Association, Inc. (The); [www.ntma.com](http://www.ntma.com).
158. NWFA - National Wood Flooring Association; [www.nwfa.org](http://www.nwfa.org).
159. PCI - Precast/Prestressed Concrete Institute; [www.pci.org](http://www.pci.org).
160. PDI - Plumbing & Drainage Institute; [www.pdionline.org](http://www.pdionline.org).

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

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

1. DIN - Deutsches Institut fur Normung e.V.; [www.din.de](http://www.din.de).
2. IAPMO - International Association of Plumbing and Mechanical Officials; [www.iapmo.org](http://www.iapmo.org).
3. ICC - International Code Council; [www.iccsafe.org](http://www.iccsafe.org).
4. ICC-ES - ICC Evaluation Service, LLC; [www.icc-es.org](http://www.icc-es.org).

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

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

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

1. CFR - Code of Federal Regulations; Available from Government Printing Office; [www.gpo.gov/fdsys](http://www.gpo.gov/fdsys).
2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; [www.quicksearch.dla.mil](http://www.quicksearch.dla.mil).
3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).

5. FS - Federal Specification; Available from DLA Document Services; [www.quicksearch.dla.mil](http://www.quicksearch.dla.mil).
    - a. Available from Defense Standardization Program; [www.dsp.dla.mil](http://www.dsp.dla.mil).
    - b. Available from General Services Administration; [www.gsa.gov](http://www.gsa.gov).
    - c. Available from National Institute of Building Sciences/Whole Building Design Guide; [www.wbdg.org/ccb](http://www.wbdg.org/ccb).
  6. MILSPEC - Military Specification and Standards; (See DOD).
  7. USAB - United States Access Board; [www.access-board.gov](http://www.access-board.gov).
  8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).
- F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; [www.bearhfti.ca.gov](http://www.bearhfti.ca.gov).
  2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; [www.calregs.com](http://www.calregs.com).
  3. CDHS; California Department of Health Services; (See CDPH).
  4. CDPH; California Department of Public Health; Indoor Air Quality Program; [www.cal-iaq.org](http://www.cal-iaq.org).
  5. CPUC; California Public Utilities Commission; [www.cpuc.ca.gov](http://www.cpuc.ca.gov).
  6. SCAQMD; South Coast Air Quality Management District; [www.aqmd.gov](http://www.aqmd.gov).
  7. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; [www.txforestservation.tamu.edu](http://www.txforestservation.tamu.edu).

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

## SECTION 016000 - PRODUCT REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
  - 1. Section 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 the "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 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
    - a. Form of Approval: As specified in Section 013300 "Submittal Procedures."
    - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

#### 1.5 QUALITY ASSURANCE

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

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

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with the 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. Manufacturers' disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. **Manufacturer's Warranty:** Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. **Special Warranty:** Written warranty required by the Contract Documents to provide specific rights for Owner.

- B. **Special Warranties:** Prepare a written document that contains appropriate terms and identification, ready for execution.

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

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

## PART 2 - PRODUCTS

### 2.1 PRODUCT SELECTION PROCEDURES

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

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
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. Non-restricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in the "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 the requirements in the "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 the "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 the proposed product provides specified warranty.
  - 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
  - 5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

## SECTION 017300 - EXECUTION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of Owner-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.

- B. Related Requirements:

1. Section 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.
3. Section 024119 "Selective Demolition" for demolition and removal of selected portions of the building.
4. Section 078413 "Penetration Firestopping" for patching penetrations in fire-rated construction.

#### 1.3 DEFINITIONS

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

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Cutting and Patching Plan: Submit plan describing procedures at least **10** days prior to the time cutting and patching will be performed. Include the following information:

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
3. Products: List products to be used for patching and firms or entities that will perform patching work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
  - a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

## 1.5 QUALITY ASSURANCE

- A. 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.
  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.
- B. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.
- C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

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

## PART 3 - EXECUTION

### 3.1 EXAMINATION

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

### 3.2 PREPARATION

- A. 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.
  - 4. Maintain minimum headroom clearance of 96 inches (2440 mm) in occupied spaces and 90 inches (2300 mm) in unoccupied spaces.
- B. Comply with the 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 the 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 prevent interruption to occupied areas.
- G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

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

- A. Site Access: Provide access to Project site for Owner's construction personnel.

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

### 3.6 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 for more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
  - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
    - a. Use containers intended for holding waste materials of type to be stored.
  - 4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
  - 1. Remove liquid spills promptly.
  - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### 3.7 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 them 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."

### 3.8 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 manufacturers' written instructions for temperature and relative humidity.

END OF SECTION 017300

## SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:

- 1. Salvaging non-hazardous demolition and construction waste.
- 2. Recycling non-hazardous demolition and construction waste.
- 3. Disposing of nonhazardous demolition and construction waste.

- B. Related Requirements:

- 1. Section 042000 "Unit Masonry" for disposal requirements for masonry waste.

#### 1.3 DEFINITIONS

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

#### 1.4 ACTION SUBMITTALS

- A. Waste Management Plan: Submit plan within **7** days of date established for commencement of the Work.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Use Form CWM-7 for construction waste and Form CWM-8 for demolition waste. Include the following information:
1. Material category.
  2. Generation point of waste.
  3. Total quantity of waste in **tons (tonnes)**.
  4. Quantity of waste salvaged, both estimated and actual in **tons (tonnes)**.
  5. Quantity of waste recycled, both estimated and actual in **tons (tonnes)**.
  6. Total quantity of waste recovered (salvaged plus recycled) in **tons (tonnes)**.
  7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

## 1.6 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
1. Review and discuss waste management plan including responsibilities of waste management coordinator.
  2. Review requirements for documenting quantities of each type of waste and its disposition.
  3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
  4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
  5. Review waste management requirements for each trade.

## 1.7 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Distinguish between demolition and construction waste. Indicate quantities by weight or volume but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition and construction waste generated by the Work. Use Form CWM-1 for construction waste and Form CWM-2 for demolition waste. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use Form CWM-3 for construction waste and Form CWM-4 for demolition waste. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
  - 1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
  - 2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
  - 3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
  - 4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
  - 5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
  - 6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
  - 1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."
- B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
  2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.

### 3.2 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:
1. Clean salvaged items.
  2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
  3. Store items in a secure area until installation.
  4. Protect items from damage during transport and storage.
  5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- B. Salvaged Items for Sale and Donation: Not permitted on Project site.
- C. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:
1. Clean salvaged items.
  2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
  3. Store items in a secure area until delivery to Owner.
  4. Transport items to Owner's storage area designated by Owner.
  5. Protect items from damage during transport and storage.
- D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.
- E. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
- F. Plumbing Fixtures: Separate by type and size.
- G. Lighting Fixtures: Separate lamps by type and protect from breakage.
- H. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

### 3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.
- C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
- D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
  - 1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
    - a. Inspect containers and bins for contamination and remove contaminated materials if found.
  - 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
  - 4. Store components off the ground and protect from the weather.
  - 5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

### 3.4 RECYCLING DEMOLITION WASTE

- A. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
  - 1. Clean and stack undamaged, whole masonry units on wood pallets.
- B. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
- C. Metals: Separate metals by type.
  - 1. Structural Steel: Stack members according to size, type of member, and length.
  - 2. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- D. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.
- E. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

- F. Conduit: Reduce conduit to straight lengths and store by type and size.

### 3.5 RECYCLING CONSTRUCTION WASTE

#### A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

#### B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

### 3.6 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

- B. Burning: Do not burn waste materials.

- C. Burning: Burning of waste materials is permitted only at designated areas on Owner's property, provided required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.

- D. Disposal: Remove waste materials from Owner's property and legally dispose of them.

### 3.7 ATTACHMENTS

- A. Form CWM-1 for construction waste identification.
- B. Form CWM-2 for demolition waste identification.
- C. Form CWM-7 for construction waste
- D. Form CWM-8 for demolition waste.

END OF SECTION 017419

<b>FORM CWM-1: CONSTRUCTION WASTE IDENTIFICATION</b>							
<b>MATERIAL CATEGORY</b>	<b>GENERATION POINT</b>	<b>EST. QUANTITY OF MATERIALS RECEIVED* (A)</b>	<b>EST. WASTE - % (B)</b>	<b>TOTAL EST. QUANTITY OF WASTE* (C = A x B)</b>	<b>EST. VOLUME CY (CM)</b>	<b>EST. WEIGHT TONS (TONNES)</b>	<b>REMARKS AND ASSUMPTIONS</b>
Packaging: Cardboard							
Packaging: Boxes							
Packaging: Plastic Sheet or Film							
Packaging: Polystyrene							
Packaging: Pallets or Skids							
Packaging: Crates							
Packaging: Paint Cans							
Packaging: Plastic Pails							
Site-Clearing Waste							
Masonry or CMU							
Lumber: Cut-Offs							
Lumber: Warped Pieces							
Plywood or OSB (scraps)							
Wood Forms							
Wood Waste Chutes							
Wood Trim (cut-offs)							
Metals							
Insulation							
Roofing							
Joint Sealant Tubes							
Gypsum Board (scraps)							
Carpet and Pad (scraps)							
Piping							
Electrical Conduit							
Other:							

\* Insert units of measure.

<b>FORM CWM-2: DEMOLITION WASTE IDENTIFICATION</b>				
<b>MATERIAL DESCRIPTION</b>	<b>EST. QUANTITY</b>	<b>EST. VOLUME CY (CM)</b>	<b>EST. WEIGHT TONS (TONNES)</b>	<b>REMARKS AND ASSUMPTIONS</b>
Asphaltic Concrete Paving				
Concrete				
Brick				
CMU				
Lumber				
Plywood and OSB				
Wood Paneling				
Wood Trim				
Miscellaneous Metals				
Structural Steel				
Rough Hardware				
Insulation				
Roofing				
Doors and Frames				
Door Hardware				
Windows				
Glazing				
Acoustical Tile				
Carpet				
Carpet Pad				
Demountable Partitions				
Equipment				
Cabinets				
Plumbing Fixtures				
Piping				
Piping Supports and Hangers				
Valves				
Sprinklers				
Mechanical Equipment				
Electrical Conduit				
Copper Wiring				
Light Fixtures				
Lamps				
Lighting Ballasts				
Electrical Devices				
Switchgear and Panelboards				
Transformers				
Other:				

FORM CWM-7: CONSTRUCTION WASTE REDUCTION PROGRESS REPORT								
MATERIAL CATEGORY	GENERATION POINT	TOTAL QUANTITY OF WASTE TONS (TONNES) (A)	QUANTITY OF WASTE SALVAGED		QUANTITY OF WASTE RECYCLED		TOTAL QUANTITY OF WASTE RECOVERED TONS (TONNES) (D = B + C)	TOTAL QUANTITY OF WASTE RECOVERED % (D / A x 100)
			ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (B)	ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (C)		
Packaging: Cardboard								
Packaging: Boxes								
Packaging: Plastic Sheet or Film								
Packaging: Polystyrene								
Packaging: Pallets or Skids								
Packaging: Crates								
Packaging: Paint Cans								
Packaging: Plastic Pails								
Site-Clearing Waste								
Masonry or CMU								
Lumber: Cut-Offs								
Lumber: Warped Pieces								
Plywood or OSB (scraps)								
Wood Forms								
Wood Waste Chutes								
Wood Trim (cut-offs)								
Metals								
Insulation								
Roofing								
Joint Sealant Tubes								
Gypsum Board (scraps)								
Carpet and Pad (scraps)								
Piping								
Electrical Conduit								
Other:								

<b>FORM CWM-8: DEMOLITION WASTE REDUCTION PROGRESS REPORT</b>								
MATERIAL CATEGORY	GENERATION POINT	TOTAL QUANTITY OF WASTE TONS (TONNES) (A)	QUANTITY OF WASTE SALVAGED		QUANTITY OF WASTE RECYCLED		TOTAL QUANTITY OF WASTE RECOVERED TONS (TONNES) (D = B + C)	TOTAL QUANTITY OF WASTE RECOVERED % (D / A x 100)
			ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (B)	ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (C)		
Asphaltic Concrete Paving								
Concrete								
Brick								
CMU								
Lumber								
Plywood and OSB								
Wood Paneling								
Wood Trim								
Miscellaneous Metals								
Structural Steel								
Rough Hardware								
Insulation								
Roofing								
Doors and Frames								
Door Hardware								
Windows								
Glazing								
Acoustical Tile								
Carpet								
Carpet Pad								
Demountable Partitions								
Equipment								
Cabinets								
Plumbing Fixtures								
Piping								
Supports and Hangers								
Valves								
Sprinklers								
Mechanical Equipment								
Electrical Conduit								
Copper Wiring								
Light Fixtures								
Lamps								
Lighting Ballasts								
Electrical Devices								
Switchgear and Panelboards								

<b>Transformers</b>								
<b>Other:</b>								

## SECTION 017700 - CLOSEOUT PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
  - 1. Substantial Completion procedures.
  - 2. Final completion procedures.
  - 3. Warranties.
  - 4. Final cleaning.
  - 5. Repair of the Work.
- B. Related Requirements:
  - 1. Section 013233 "Photographic Documentation" for submitting final completion construction photographic documentation.
  - 2. Section 017300 "Execution" for progress cleaning of Project site.
  - 3. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
  - 4. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
  - 5. 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 **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.
6. Submit sustainable design submittals not previously submitted.
7. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
  1. Advise Owner of pending insurance changeover requirements.
  2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
  3. Complete startup and testing of systems and equipment.

4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 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 **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 electronic file. Architect will return annotated file.
    - b. PDF electronic file. Architect will return annotated file.

## 1.9 SUBMITTAL OF PROJECT WARRANTIES

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

## PART 2 - PRODUCTS

### 2.1 MATERIALS

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

## PART 3 - EXECUTION

### 3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with the 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. Remove tools, construction equipment, machinery, and surplus material from Project site.
    - c. Remove snow and ice to provide safe access to building.
    - d. 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.
    - e. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    - f. Sweep concrete floors broom clean in unoccupied spaces.
    - g. Remove labels that are not permanent.
    - h. Wipe surfaces of mechanical and electrical equipment, elevator equipment,] and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
    - i. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
    - j. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

- k. 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.
  - l. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
  - m. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.
- D. Construction Waste Disposal: Comply with waste disposal requirements in Section 017419 "Construction Waste Management and Disposal."

### 3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
- 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
  - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that 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.

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Operation and maintenance documentation directory.
  - 2. Emergency manuals.
  - 3. Operation manuals for systems, subsystems, and equipment.
  - 4. Product maintenance manuals.
  - 5. Systems and equipment maintenance manuals.
- B. Related Requirements:
  - 1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
  - 2. Section 019113 "General Commissioning Requirements" for verification and compilation of data into 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.
- C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect will comment on whether the general scope and content of manual are acceptable.
- D. Final Manual Submittal: Submit each manual in the final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect will return the copy with comments.
  1. Correct or revise each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments and prior to commencing demonstration and training.

## PART 2 - PRODUCTS

### 2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

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

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

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
1. Title page.
  2. Table of contents.
  3. Manual contents.
- B. Title Page: Include the following information:
1. Subject matter included in manual.
  2. Name and address of Project.
  3. Name and address of Owner.
  4. Date of submittal.
  5. Name and contact information for Contractor.
  6. Name and contact information for Architect.
  7. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
  8. 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, post-type 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 EMERGENCY MANUALS

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

- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
  - 1. Instructions on stopping.
  - 2. Shutdown instructions for each type of emergency.
  - 3. Operating instructions for conditions outside normal operating limits.
  - 4. Required sequences for electric or electronic systems.
  - 5. Special operating instructions and procedures.

## 2.4 OPERATION MANUALS

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

7. Seasonal and weekend operating instructions.
  8. Required sequences for electric or electronic systems.
  9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed and identify color-coding where required for identification.

## 2.5 PRODUCT MAINTENANCE MANUALS

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

## 2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures,

maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
  - 1. Standard maintenance instructions and bulletins.
  - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
  - 3. Identification and nomenclature of parts and components.
  - 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
  - 1. Test and inspection instructions.
  - 2. Troubleshooting guide.
  - 3. Precautions against improper maintenance.
  - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - 5. Aligning, adjusting, and checking instructions.
  - 6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
  - 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
  - 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
  - 1. Include procedures to follow and required notifications for warranty claims.

## PART 3 - EXECUTION

### 3.1 MANUAL PREPARATION

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

END OF SECTION 017823

## SECTION 017839 - PROJECT RECORD DOCUMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
  - 1. Record Drawings.
  - 2. Record Specifications.
  - 3. Record Product Data.
  - 4. Miscellaneous record submittals.
- B. Related Requirements:
  - 1. Section 017700 "Closeout Procedures" for general closeout procedures.
  - 2. 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 set(s) of marked-up record prints.
  - 2. Number of Copies: Submit copies of record Drawings as follows:
    - a. Initial Submittal:
      - 1) Submit one paper-copy set(s) of marked-up record prints.
      - 2) Submit PDF electronic files of scanned record prints and one of file prints.
      - 3) Submit record digital data files and one 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 paper-copy set(s) of marked-up record prints.
      - 2) Submit PDF electronic files of scanned record prints and three set(s) of prints.
      - 3) Print each drawing, whether or not changes and additional information were recorded.

- c. Final Submittal:
  - 1) Submit one paper-copy set(s) of marked-up record prints.
  - 2) Submit record digital data files and three 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 annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit annotated PDF electronic files and directories] of each submittal.
  - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.
- 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 Construction Change Directive.
  - k. Changes made following Architect's written orders.
  - l. Details not on the original Contract Drawings.
  - m. Field records for variable and concealed conditions.
  - n. Record information on the Work that is shown only schematically.
3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
  4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
  5. Mark important additional information that was either shown schematically or omitted from original Drawings.
  6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect and Construction Manager. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
  2. Format: DWG, RVT, Version 2025, Microsoft Windows operating system.
  3. Format: Annotated PDF electronic file with comment function enabled.
  4. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
  5. Refer instances of uncertainty to Architect for resolution.
  6. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
    - a. See Section 013300 "Submittal Procedures" for requirements related to use of Architect's digital data files.
    - b. Architect will provide data file layer information. Record markups in separate layers.
- C. 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.

- D. 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 and Construction Manager.
    - e. Name of Contractor.

## 2.2 RECORD SPECIFICATIONS

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

## 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 manufacturers' written instructions for installation.
  3. Note related Change Orders, record Specifications, and record Drawings where applicable.
- B. Format: Submit record Product Data as annotated PDF electronic file.

1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

#### 2.4 MISCELLANEOUS RECORD SUBMITTALS

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

### PART 3 - EXECUTION

#### 3.1 RECORDING AND MAINTENANCE

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

END OF SECTION 017839

## SECTION 017900 - DEMONSTRATION AND TRAINING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
  - 1. Demonstration of operation of systems, subsystems, and equipment.
  - 2. Training in operation and maintenance of systems, subsystems, and equipment.
  - 3. Demonstration and training video recordings.
- B. Allowances: Furnish demonstration and training instruction time under the Demonstration and Training Allowance as specified in Section 012100 "Allowances."
- C. Unit Price for Instruction Time: Length of instruction time will be measured by actual time spent performing demonstration and training in required location. No payment will be made for time spent assembling educational materials, setting up, or cleaning up. See requirements in Section 012200 "Unit Prices."

#### 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.

#### 1.4 CLOSEOUT SUBMITTALS

- A. Demonstration and Training Video Recordings: Submit two copies within seven days of the 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.
  3. Transcript: Prepared in PDF electronic format. Include a cover sheet with same label information as the corresponding video recording and a table of contents with links to corresponding training components. Include name of Project and date of video recording on each page.
  4. 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.

#### 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 with at least seven days' advance notice.
- D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration 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 .mp4 format file type or 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 a 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 electronic file 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 019113 - GENERAL COMMISSIONING 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. Owner's Project Requirements and Basis-of-Design documentation are included by reference for information only.

#### 1.2 SUMMARY

##### A. Section Includes:

1. General requirements for coordinating and scheduling commissioning.
2. Commissioning meetings.
3. Commissioning reports.
4. Use of test equipment, instrumentation, and tools for commissioning.
5. Construction checklists, including, but not limited to, installation checks, startup, performance tests, and performance test demonstration.
6. Commissioning tests and commissioning test demonstration.
7. Adjusting, verifying, and documenting identified systems and assemblies.

##### B. Related Requirements:

1. Section 013300 "Submittal Procedures" for submittal procedures requirements for commissioning.
2. Section 017700 "Closeout Procedures" for certificate of Construction Phase Commissioning Completion submittal requirements.
3. Section 017823 "Operation and Maintenance Data" for preliminary operation and maintenance data submittal.
4. Section 110800 "Commissioning of Equipment" for technical commissioning requirements for building equipment.
5. Section 130800 "Commissioning of Special Construction" for technical commissioning requirements for special construction.
6. Section 210800 "Commissioning of Fire Suppression" for technical commissioning requirements for fire suppression.
7. Section 220800 "Commissioning of Plumbing" for technical commissioning requirements for plumbing.
8. Section 230800 "Commissioning of HVAC" for technical commissioning requirements for HVAC.
9. Section 260800 "Commissioning of Electrical Systems" for technical commissioning requirements for electrical systems.
10. Section 270800 "Commissioning of Communications" for technical commissioning requirements for communications systems.

### 1.3 ALLOWANCES

- A. Labor and management costs for the performance of commissioning.
- B. The following are excluded from the commissioning allowance:
  - 1. Equipment and systems installation, startup, and field quality-control testing indicated in the Contract Documents.
  - 2. Test equipment, instrumentation, and tools (including, but not limited to, proprietary test equipment, instrumentation, and tools) required to perform tests.
  - 3. Work to correct commissioning issues.
  - 4. Work to repeat tests when equipment and systems fail acceptance criteria.

### 1.4 UNIT PRICES

- A. Commissioning allowance may be adjusted up or down by the "List of Unit Prices" in bid form when actual labor hours are computed at the end of commissioning.
- B. The following are excluded from the computation for the adjustment of the commissioning allowance for technician labor hours:
  - 1. Work to correct commissioning issues.
  - 2. Work to repeat tests when equipment and systems fail acceptance criteria.

### 1.5 DEFINITIONS

- A. Acceptance Criteria: Threshold of acceptable work quality or performance specified for a commissioning activity, including, but not limited to, construction checklists, performance tests, performance test demonstrations, commissioning tests and commissioning test demonstrations.
- B. Basis-of-Design Document: A document prepared by Owner, Architect, or Commissioning Authority that records concepts, calculations, decisions, and product selections used to comply with Owner's Project Requirements and to suit applicable regulatory requirements, standards, and guidelines.
- C. Commissioning Authority: An entity engaged by Owner, and identified in Section 011000 "Summary," to evaluate Commissioning-Process Work.
- D. Commissioning Plan: A document, prepared by Commissioning Authority, that outlines the organization, schedule, allocation of resources, and documentation requirements of commissioning.
- E. Commissioning: A quality-focused process for verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, and tested to comply with Owner's Project Requirements. The requirements specified here are limited to the construction phase commissioning activities. The scope of commissioning is defined in Section 011000 "Summary."
- F. Construction Phase Commissioning Completion: The stage of completion and acceptance of commissioning when resolution of deficient conditions and issues discovered during

commissioning and retesting until acceptable results are obtained has been accomplished. Owner will establish in writing the date Construction Phase Commissioning Completion is achieved. See Section 017700 "Closeout Procedures" for certificate of Construction Phase Commissioning Completion submittal requirements.

1. Commissioning is complete when the work specified in this Section and related Sections has been completed and accepted, including, but not limited to, the following:
  - a. Completion of tests and acceptance of test results.
  - b. Resolution of issues, as verified by retests performed and documented with acceptance of retest results.
  - c. Comply with requirements in Section 017900 "Demonstration and Training."
  - d. Completion and acceptance of submittals and reports.
- G. Owner's Project Requirements: A document written by Owner, Architect, or Commissioning Authority that details the functional requirements of a project and the expectations of how it will be used and operated, including Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.
- H. Owner's Witness: Commissioning Authority, Owner's Project Manager, or Architect-designated witness authorized to authenticate test demonstration data and to sign completed test data forms.
- I. "Systems," "Assemblies," "Subsystems," "Equipment," and "Components": Where these terms are used together or separately, they shall mean "as-built" systems, assemblies, subsystems, equipment, and components.
- J. Test: Performance tests, performance test demonstrations, commissioning tests, and commissioning test demonstrations.
- K. Sampling Procedures and Tables for Inspection by Attributes: As defined in ASQ Z1.4.

## 1.6 COMPENSATION

- A. Should Architect, Commissioning Authority, other Owner's witness, or Owner's staff perform additional services or incur additional expenses due to actions of Contractor listed below, compensate Owner for such additional services and expenses.
  1. Failure to provide timely notice of commissioning activities schedule changes.
  2. Failure to meet acceptance criteria for test demonstrations.
- B. Contractor shall compensate Owner for such additional services and expenses at the rate of \$150.00 per labor hour plus \$500.00 per round trip for personnel travelling more than 200 miles plus per diem allowances for meals and lodging according to current U.S. General Services Administration (GSA) Per Diem Rates.

## 1.7 COMMISSIONING TEAM

- A. Members Appointed by Contractor(s):

1. Commissioning Coordinator: A person or entity employed by Contractor to manage, schedule, and coordinate commissioning.
2. Project superintendent and other employees that Contractor may deem appropriate for a particular portion of the commissioning.
3. Subcontractors, installers, suppliers, and specialists that Contractor may deem appropriate for a particular portion of the commissioning.
4. Appointed team members shall have the authority to act on behalf of the entity they represent.

B. Members Appointed by Owner:

1. Commissioning authority, plus consultants that Commissioning Authority may deem appropriate for a particular portion of the commissioning.
2. Owner representative(s), facility operations and maintenance personnel, plus other employees, separate contractors, and consultants that Owner may deem appropriate for a particular portion of the commissioning.
3. Architect, plus employees and consultants that Architect may deem appropriate for a particular portion of the commissioning.

## 1.8 INFORMATIONAL SUBMITTALS

A. Comply with requirements in Section 013300 "Submittal Procedures" for submittal procedures general requirements for commissioning.

B. Commissioning Plan Information:

1. List of Contractor-appointed commissioning team members to include specific personnel and subcontractors to the performance of the various commissioning requirements.
2. Schedule of commissioning activities, integrated with the construction schedule. Comply with requirements in Section 013200 "Construction Progress Documentation" for construction schedule general requirements for commissioning.
3. Contractor personnel and subcontractors to participate in each test.
4. List of instrumentation required for each test to include identification of parties that will provide instrumentation for each test.

C. Commissioning schedule.

D. Two-week look-ahead schedules.

E. Commissioning Coordinator Letter of Authority:

1. Within 10 days after approval of Commissioning Coordinator qualifications, submit a letter of authority for Commissioning Coordinator, signed by a principal of Contractor's firm. Letter shall authorize Commissioning Coordinator to do the following:
  - a. Make inspections required for commissioning.
  - b. Coordinate, schedule, and manage commissioning of Contractor, subcontractors, and suppliers.
  - c. Obtain documentation required for commissioning from Contractor, subcontractors, and suppliers.

- d. Report issues, delayed resolution of issues, schedule conflicts, and lack of cooperation or expertise on the part of members of the commissioning team.
- F. Commissioning Coordinator Qualification Data: For entity coordinating Contractor's commissioning activities to demonstrate their capabilities and experience.
  1. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- G. List test instrumentation, equipment, and monitoring devices. Include the following information:
  1. Make, model, serial number, and application for each instrument, equipment, and monitoring device.
  2. Brief description of intended use.
  3. Calibration record showing the following:
    - a. Calibration agency, including name and contact information.
    - b. Last date of calibration.
    - c. Range of values for which calibration is valid.
    - d. Certification of accuracy.
    - e. N.I.S.T. traceability certification for calibration equipment.
    - f. Due date of the next calibration.
- H. Test Reports:
  1. Pre-Startup Report: Prior to start up of equipment or a system, submit signed, completed construction checklists.
  2. Test Data Reports: At the end of each day in which tests are conducted, submit test data for tests performed.
  3. Commissioning Issues Reports: Daily, at the end of each day in which tests are conducted, submit commissioning issue reports for tests for which acceptable results were not achieved.
  4. Weekly Progress Report: Weekly, at the end of each week in which tests are conducted, submit a progress report.
  5. Data Trend Logs: Submit data trend logs at the end of the trend log period.
  6. System Alarm Logs: Daily, at the start of days following a day in which tests were performed, submit print-out of log of alarms that occurred since the last log was printed.
- I. Construction Checklists:
  1. Material checks.
  2. Installation checks.
  3. Startup procedures, where required.

## 1.9 CLOSEOUT SUBMITTALS

- A. Commissioning Report:

1. At Construction Phase Commissioning Completion, include the following:
  - a. Pre-startup reports.
  - b. Approved test procedures.
  - c. Test data forms, completed and signed.
  - d. Progress reports.
  - e. Commissioning issues report log.
  - f. Commissioning issues reports showing resolution of issues.
  - g. Correspondence or other documents related to resolution of issues.
  - h. Other reports required by commissioning.
  - i. List unresolved issues and reasons they remain unresolved and should be exempted from the requirements for Construction Phase Commissioning Completion.
  - j. Report shall include commissioning work of Contractor.
- B. Request for Certificate of Construction Phase Commissioning Completion.
- C. Operation and Maintenance Data: For proprietary test equipment, instrumentation, and tools to include in operation and maintenance manuals.

#### 1.10 QUALITY ASSURANCE

- A. Commissioning Coordinator Qualifications:
  1. Documented experience commissioning systems of similar complexity to those contained in these documents on at least three projects of similar scope and complexity.
  2. Certification of commissioning process expertise. The following certifications are acceptable. Owner reserves the right to accept or reject certifications as evidence of qualification.
    - a. Certified Commissioning Professional, by Building Commissioning Association.
    - b. Commissioning Process Management Professional, by American Society of Heating, Refrigerating and Air-Conditioning Engineers.
    - c. Accredited Commissioning Process Authority Professional, by University of Wisconsin.
    - d. Accredited Commissioning Process Manager, by University of Wisconsin.
    - e. Accredited Green Commissioning Process Provider, by University of Wisconsin.
- B. Calibration Agency Qualifications: Certified by The American Association of Laboratory Accreditation that the calibration agency complies with minimum requirements of ISO/IEC 17025.

#### 1.11 COMMISSIONING AUTHORITY'S RESPONSIBILITIES

- A. Commissioning Authority Responsibilities: Comply with requirements in Section 011000 "Summary."

## PART 2 - PRODUCTS

### 2.1 TEST EQUIPMENT, INSTRUMENTATION, AND TOOLS

- A. Test equipment and instrumentation required to perform the commissioning shall remain the property of Contractor unless otherwise indicated.
- B. Test equipment and instrumentation required to perform commissioning shall comply with the following criteria:
  - 1. Be manufactured for the purpose of testing and measuring tests for which they are being used and have an accuracy to test and measure system performance within the tolerances required to determine acceptable performance.
  - 2. Calibrated and certified.
    - a. Calibration performed and documented by a qualified calibration agency according to national standards applicable to the tools and instrumentation being calibrated. Calibration shall be current according to national standards or within test equipment and instrumentation manufacturer's recommended intervals, whichever is more frequent, but not less than within six months of initial use on Project. Calibration tags permanently affixed.
    - b. Repair and recalibrate test equipment and instrumentation if dismantled, dropped, or damaged since last calibrated.
  - 3. Maintain test equipment and instrumentation.
  - 4. Use test equipment and instrumentation only for testing or monitoring Work for which they are designed.

### 2.2 PROPRIETARY TEST EQUIPMENT, INSTRUMENTATION, AND TOOLS

- A. Proprietary test equipment, instrumentation, and tools are those manufactured or prescribed by tested equipment manufacturer and required for work on its equipment as a condition of equipment warranty, or as otherwise required to service, repair, adjust, calibrate, or perform work on its equipment.
  - 1. Identify proprietary test equipment, instrumentation, and tools required in the test equipment identification list submittal.
  - 2. Proprietary test equipment, instrumentation, and tools shall become the property of Owner at Substantial Completion.

### 2.3 REPORT FORMAT AND ORGANIZATION

- A. General Format and Organization:
  - 1. Bind report in three-ring binders.
  - 2. Label the front cover and spine of each binder with the report title, volume number, project name, Contractor's name, and date of report.
  - 3. Record report on compact disk.

4. Electronic Data: Portable document format (PDF); a single file with outline-organized bookmarks for major and minor tabs and tab contents itemized for specific reports.

B. Commissioning Report:

1. Include a table of contents and an index to each test.
2. Include major tabs for each Specification Section.
3. Include minor tabs for each test.
4. Within each minor tab, include the following:
  - a. Test specification.
  - b. Pre-startup reports.
  - c. Approved test procedures.
  - d. Test data forms, completed and signed.
  - e. Commissioning issue reports, showing resolution of issues, and documentation related to resolution of issues pertaining to a single test. Group data forms, commissioning issue reports showing resolution of issues, and documentation related to resolution of issues for each test repetition together within the minor tab, in reverse chronological order (most recent on top).

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Review preliminary construction checklists and preliminary test procedures and data forms.

### 3.2 CONSTRUCTION CHECKLISTS

- A. Construction checklists cannot modify or conflict with the Contract Documents.
- B. Create construction checklists based on actual systems and equipment to be included in Project.
- C. Material Checks: Compare specified characteristics and approved submittals with materials as received. Include factory tests and other evaluations, adjustments, and tests performed prior to shipment, if applicable.
  1. Services connection requirements, including configuration, size, location, and other pertinent characteristics.
  2. Included optional features.
  3. Delivery Receipt Check: Inspect and record physical condition of materials and equipment on delivery to Project site, including agreement with approved submittals, cleanliness and lack of damage.
  4. Installation Checks:
    - a. Location according to Drawings and approved Shop Drawings.
    - b. Configuration.
    - c. Compliance with manufacturers' written installation instructions.
    - d. Attachment to structure.

- e. Access clearance to allow for maintenance, service, repair, removal, and replacement without the need to disassemble or remove other equipment or building elements. Access coordinated with other building elements and equipment, including, but not limited to, ceiling and wall access panels, in a manner consistent with OSHA fall-protection regulations and safe work practices.
  - f. Utility connections are of the correct characteristics, as applicable.
  - g. Correct labeling and identification.
  - h. Startup Checks: Verify readiness of equipment to be energized. Include manufacturer's standard startup procedures and forms.
- D. Startup: Perform and document initial operation of equipment to prove that it is installed properly and operates as intended according to manufacturer's standard startup procedures, minimum.
- E. Performance Tests:
- 1. Static Tests: As specified elsewhere, including, but not limited to, duct and pipe leakage tests, insulation-resistance tests, and water-penetration tests.
  - 2. Component Performance Tests: Tests evaluate the performance of an input or output of components under a full range of operating conditions.
  - 3. Equipment and Assembly Performance Tests: Test and evaluate performance of equipment and assemblies under a full range of operating conditions and loads.
  - 4. System Performance Tests: Test and evaluate performance of systems under a full range of operating conditions and loads.
  - 5. Intersystem Performance Tests: Test and evaluate the interface of different systems under a full range of operating conditions and loads.
- F. Deferred Construction Checklists: Obtain Owner approval of proposed deferral of construction checklists, including proposed schedule of completion of each deferred construction checklist, before submitting request for Certificate of Construction Phase Commissioning Completion. When approved, deferred construction checklists may be completed after date of Construction Phase Commissioning Completion. Include the following in request for Certificate of Construction Phase Commissioning Completion:
- 1. Identify deferred construction checklists by number and title.
  - 2. Provide a target schedule for completion of deferred construction checklists.
  - 3. Written approval of proposed deferred construction checklists, including approved schedule of completion of each deferred construction checklist.
- G. Delayed Construction Checklists: Obtain Owner approval of proposed delayed construction checklists, including proposed schedule of completion of each delayed construction checklist, before submitting request for Certificate of Construction Phase Commissioning Completion. When approved, delayed construction checklists may be completed after date of Construction Phase Commissioning Completion. Include the following in request for Certificate of Construction Phase Commissioning Completion:
- 1. Identify delayed construction checklist by construction checklist number and title.
  - 2. Provide a target schedule for completion of delayed construction checklists.
  - 3. Written approval of proposed delayed construction checklists, including approved schedule of completion of each delayed construction checklist.

### 3.3 GENERAL EXECUTION REQUIREMENTS

- A. Schedule and coordinate commissioning with the construction schedule.
- B. Perform activities identified in construction checklists, including tests, and document results of actions as construction proceeds.
- C. Perform test demonstrations for Owner's witness. Unless otherwise indicated, demonstrate tests for 100 percent of work to which the test applies. In some instances, demonstration of a random sample of other than 100 percent of the results of a test is specified.
  - 1. Where sampling is specified, the sampling plan and procedure for the test demonstration shall be determined using ASQ Z1.4.
    - a. General Inspection: Level I.
    - b. Special Inspection: Level S-1.
    - c. Acceptance Quality Limit (AQL) of 1.5.
  - 2. The "lot size" in ASQ Z1.4 is the sum of the number of items to which the test demonstration applies, as described in the scope subparagraph of each test.
  - 3. On determination of the sample size, the samples shall be selected randomly by Owner's witness at the time of the test demonstration.
  - 4. Include in the Commissioning Plan a detailed list of the test demonstrations with lot and sample quantities for each test.
- D. Report test data and commissioning issue resolutions.
- E. Schedule personnel to participate in and perform Commissioning-Process Work.
- F. Installing contractors' commissioning responsibilities include, but are not limited to, the following:
  - 1. Operating the equipment and systems they install during tests.
  - 2. In addition, installing contractors may be required to assist in tests of equipment and systems with which their work interfaces.

### 3.4 COMMISSIONING COORDINATOR RESPONSIBILITIES

- A. Management and Coordination: Manage, schedule, and coordinate commissioning, including, but not limited to, the following:
  - 1. Coordinate with subcontractors on their commissioning responsibilities and activities.
  - 2. Obtain, assemble, and submit commissioning documentation.
  - 3. Conduct periodic on-site commissioning meetings. Comply with requirements in Section 013100 "Project Management and Coordination."
  - 4. Develop and maintain the commissioning schedule. Integrate commissioning schedule into the construction schedule. Update schedule at specified intervals.
  - 5. Review and comment on preliminary test procedures and data forms.
  - 6. Report inconsistencies and issues in system operations.

7. Verify that tests have been completed and results comply with acceptance criteria, and that equipment and systems are ready before scheduling test demonstrations.
8. Direct and coordinate test demonstrations.
9. Coordinate witnessing of test demonstrations by Owner's witness.
10. Coordinate and manage training. Be present during training sessions to direct video recording, present training and direct the training presentations of others. Comply with requirements in Section 017900 "Demonstration and Training."
11. Prepare and submit specified commissioning reports.
12. Track commissioning issues until resolution and retesting is successfully completed.
13. Retain original records of Commissioning-Process Work, organized as required for the commissioning report. Provide Owner's representative access to these records on request.
14. Assemble and submit commissioning report.

### 3.5 COMMISSIONING TESTING

- A. Quality Control: Construction checklists, including tests, are quality-control tools designed to improve the functional quality of Project. Test demonstrations evaluate the effectiveness of Contractor's quality-control process.
- B. Owner's witness will be present to witness commissioning work requiring the signature of an owner's witness, including, but not limited to, test demonstrations. Owner's project manager will coordinate attendance by Owner's witness with Contractor's published commissioning schedule. Owner's witness will provide no labor or materials in the commissioning work. The only function of Owner's witness will be to observe and comment on the progress and results of commissioning.
- C. Construction Checklists:
  1. Complete construction checklists as Work is completed.
  2. Distribute construction checklists to installing contractors before they start work.
  3. Installers:
    - a. Verify installation using approved construction checklists as Work proceeds.
    - b. Complete and sign construction checklists weekly for work performed during the preceding week.
  4. Provide Commissioning Authority access to construction checklists.
- D. Installation Compliance Issues: Record as an installation compliance issue Work found to be incomplete, inaccessible, at variance with the Contract Documents, nonfunctional, or that does not comply with construction checklists. Record installation compliance issues on the construction checklist at the time they are identified. Record corrective action and how future Work should be modified before signing off the construction checklist.
- E. Pre-Startup Audit: Prior to executing startup procedures, review completed installation checks to determine readiness for startup and operation. Report conditions, which, if left uncorrected, adversely impact the ability of systems or equipment to operate satisfactorily or to comply with acceptance criteria. Prepare pre-startup report for each system.
- F. Test Procedures and Test Data Forms:

1. Test procedures shall define the step-by-step procedures to be used to execute tests and test demonstrations.
2. Test procedures shall be specific to the make, model, and application of the equipment and systems being tested.
3. Completed test data forms are the official records of the results of tests.
4. Commissioning Authority will provide to Contractor preliminary test procedures and test data forms for performance tests and commissioning tests after approval of Product Data, Shop Drawings, and preliminary operation and maintenance manual.
5. Review preliminary test procedures and test data forms and provide comments within 14 days of receipt from Commissioning Authority. Review shall address the following:
  - a. Equipment protection and warranty issues, including, but not limited to, manufacturers' installation and startup recommendations, and operation and maintenance instructions.
  - b. Applicability of the procedure to the specific software, equipment, and systems approved for installation.
6. After Contractor has reviewed and commented on the preliminary test procedures and test data forms, Commissioning Authority will revise and reissue the approved revised test procedures and test data forms marked "Approved for Testing."
7. Use only approved test procedures and test data forms marked "Approved for Testing" to perform and document tests and test demonstrations.

G. Performance of Tests:

1. The sampling rate for tests is 100 percent. The sampling rate for test demonstrations is 100 percent unless otherwise indicated.
2. Perform and complete each step of the approved test procedures in the order listed.
3. Record data observed during performance of tests on approved data forms at the time of test performance and when the results are observed.
4. Record test results that are not within the range of acceptable results on commissioning issue report forms in addition to recording the results on approved test procedures and data forms according to the "Commissioning Compliance Issues" Paragraph in this Article.
5. On completion of a test, sign the completed test procedure and data form. Tests for which test procedures and data forms are incomplete, not signed, or which indicate performance that does not comply with acceptance criteria will be rejected. Tests for which test procedures and data forms are rejected shall be repeated and results resubmitted.

H. Performance of Test Demonstration:

1. Perform test demonstrations on a sample of tests after test data submittals are approved. The sampling rate for test demonstrations shall be 100 percent unless otherwise indicated in the individual test specification.
2. Notify Owner's witness at least three days in advance of each test demonstration.
3. Perform and complete each step of the approved test procedures in the order listed.
4. Record data observed during performance of test demonstrations on approved data forms at the time of demonstration and when the results are observed.
5. Provide full access to Owner's witness to directly observe the performance of all aspects of system response during the test demonstration. On completion of a test demonstration,

sign the completed data form and obtain signature of Owner's witness at the time of the test to authenticate the reported results.

6. Test demonstration data forms not signed by Contractor and Owner's witness at the time of the completion of the procedure will be rejected. Test demonstrations for which data forms are rejected shall be repeated and results shall be resubmitted.
  - a. Exception for Failure of Owner's Witness to Attend: Failure of Owner's witness to be present for agreed-on schedule of test demonstration shall not delay Contractor. If Owner's witness fails to attend a scheduled test, Contractor shall proceed with the scheduled test. On completion, Contractor shall sign the data form for Contractor and for Owner's witness, and shall note the absence of Owner's witness at the scheduled time and place.
7. False load test requirements are specified in related sections.
  - a. Where false load testing is specified, provide temporary equipment, power, controls, wiring, piping, valves, and other necessary equipment and connections required to apply the specified load to the system. False load system shall be capable of steady-state operation and modulation at the level of load specified. Equipment and systems permanently installed in this work shall not be used to create the false load without Architect's written approval.

I. Deferred Tests:

1. Deferred Tests List: Identify, in the request for Certificate of Construction Phase Commissioning Completion, proposed deferred tests or other tests approved for deferral until specified seasonal or other conditions are available. When approved, deferred tests may be completed after the date of Construction Phase Commissioning Completion. Identify proposed deferred tests in the request for Certificate of Construction Phase Commissioning Completion as follows:
  - a. Identify deferred tests by number and title.
  - b. Provide a target schedule for completion of deferred tests.
2. Schedule and coordinate deferred tests. Schedule deferred tests when specified conditions are available. Notify Architect and Commissioning Authority at least three working days (minimum) in advance of tests.
3. Where deferred tests are specified, coordinate participation of necessary personnel and of Architect, Commissioning Authority, and Owner's witness. Schedule deferred tests to minimize occupant and facility impact. Obtain Architect's approval of the proposed schedule.

J. Delayed Tests:

1. Delayed Tests List: Identify, in the request for Certificate of Construction Phase Commissioning Completion, proposed delayed tests. Obtain Owner approval of proposed delayed tests, including proposed schedule of completion of each delayed test, before submitting request for Certificate of Construction Phase Commissioning Completion. Include the following in the request for Certificate of Construction Phase Commissioning Completion:

- a. Identify delayed tests by test number and title.
  - b. Written approval of proposed delayed tests, including approved schedule of completion of delayed tests.
2. Schedule and coordinate delayed tests. Schedule delayed tests when conditions that caused the delay have been rectified. Notify Architect and Commissioning Authority at least three working days (minimum) in advance of tests.
  3. Where delayed tests are approved, coordinate participation of necessary personnel and of Architect, Commissioning Authority, and Owner's witness. Schedule delayed tests to minimize occupant and facility impact. Obtain Architect's approval of the proposed schedule.

K. Commissioning Compliance Issues:

1. Test results that are not within the range of acceptable results are commissioning compliance issues.
2. Track and report commissioning compliance issues until resolution and retesting are successfully completed.
3. If a test demonstration fails, determine the cause of failure. Direct timely resolution of issue and then repeat the demonstration. If a test demonstration must be repeated due to failure caused by Contractor work or materials, reimburse Owner for billed costs for the participation in the repeated demonstration.
4. Test Results: If a test demonstration fails to meet the acceptance criteria, perform the following:
  - a. Complete a commissioning compliance issue report form promptly on discovery of test results that do not comply with acceptance criteria.
  - b. Submit commissioning compliance issue report form within 24 hours of the test.
  - c. Determine the cause of the failure.
  - d. Establish responsibility for corrective action if the failure is due to conditions found to be Contractor's responsibility.
5. Commissioning Compliance Issue Report: Provide a commissioning compliance issue report for each issue. Do not report multiple issues on the same commissioning compliance issue report.
  - a. Exception: If an entire class of devices is determined to exhibit the identical issue, they may be reported on a single commissioning compliance issue report. (For example, if all return-air damper actuators that are specified to fail to the open position are found to fail to the closed position, they may be reported on a single commissioning issue report. If a single commissioning issue report is used for multiple commissioning compliance issues, each device shall be identified in the report, and the total number of devices at issue shall be identified.
  - b. Complete and submit Part 1 of the commissioning compliance issue report immediately when the condition is observed.
  - c. Record the commissioning compliance issue report number and describe the deficient condition on the data form.
  - d. Resolve commissioning compliance issues promptly. Complete and submit Part 2 of the commissioning compliance issue report when issues are resolved.
6. Diagnose and correct failed test demonstrations as follows:

- a. Perform diagnostic tests and activities required to determine the fundamental cause of issues observed.
  - b. Record each step of the diagnostic procedure prior to performing the procedure. Update written procedure as changes become necessary.
  - c. Record the results of each step of the diagnostic procedure.
  - d. Record the conclusion of the diagnostic procedure on the fundamental cause of the issue.
  - e. Determine and record corrective measures.
  - f. Include diagnosis of fundamental cause of issues in commissioning compliance issue report.
7. Retest:
- a. Schedule and repeat the complete test procedure for each test demonstration for which acceptable results are not achieved. Obtain signature of Owner's witness on retest data forms. Repeat test demonstration until acceptable results are achieved. Except for issues that are determined to result from design errors or omissions, or other conditions beyond Contractor's responsibility, compensate Owner for direct costs incurred as the result of repeated test demonstrations to achieve acceptable results.
  - b. For each repeated test demonstration, submit a new test data form, marked "Retest."
8. Do not correct commissioning compliance issues during test demonstrations.
- a. Exceptions will be allowed if the cause of the issue is obvious and resolution can be completed in less than **five** minutes. If corrections are made under this exception, note the deficient conditions on the test data form and issue a commissioning compliance issue report. A new test data form, marked "Retest," shall be initiated after the resolution has been completed.

### 3.6 COMMISSIONING MEETINGS

- A. Schedule and conduct commissioning meetings. Comply with requirements in Section 013100 "Project Management and Coordination."

### 3.7 SEQUENCING

- A. Sequencing of Commissioning Verification Activities: For a particular material, item of equipment, assembly, or system, perform the following in the order listed unless otherwise indicated:
  - 1. Construction Checklists:
    - a. Material checks.
    - b. Installation checks.
    - c. Start up, as appropriate. Some startup may depend on component performance. Such startup may follow component performance tests on which the startup depends.

d. Performance Tests:

- 1) Static tests, as appropriate.
- 2) Component performance tests. Some component performance tests may depend on completion of startup. Such component performance tests may follow startup.
- 3) Equipment and assembly performance tests.
- 4) System performance tests.
- 5) Intersystem performance tests.

2. Commissioning tests.

- B. Before performing commissioning tests, verify that materials, equipment, assemblies, and systems are delivered, installed, started, and adjusted to perform according to construction checklists.
- C. Verify readiness of materials, equipment, assemblies, and systems by performing tests prior to performing test demonstrations. Notify Architect if acceptable results cannot be achieved due to conditions beyond Contractor's control or responsibility.
- D. Commence tests as soon as installation checks for materials, equipment, assemblies, or systems are satisfactorily completed. Tests of a particular system may proceed prior to completion of other systems, provided the incomplete work does not interfere with successful execution of test.

### 3.8 SCHEDULING

- A. Commence commissioning as early in the construction period as possible.
- B. Commissioning Schedule: Integrate commissioning into Contractor's construction schedule. See Section 013200 "Construction Progress Documentation."
  1. Include detailed commissioning activities in monthly updated Contractor's construction schedule and short interval schedule submittals.
  2. Schedule the start date and duration for the following commissioning activities:
    - a. Submittals.
    - b. Preliminary operation and maintenance manual submittals.
    - c. Installation checks.
    - d. Startup, where required.
    - e. Performance tests.
    - f. Performance test demonstrations.
    - g. Commissioning tests.
    - h. Commissioning test demonstrations.
  3. Schedule shall include a line item for each installation check, startup, and test activity specific to the equipment or systems involved.
  4. Determine milestones and prerequisites for commissioning. Show commissioning milestones, prerequisites, and dependencies in monthly updated critical-path-method construction schedule and short interval schedule submittals.

C. Two-Week Look-Ahead Commissioning Schedule:

1. Two weeks prior to the beginning of tests, submit a detailed two-week look-ahead schedule. Thereafter, submit updated two-week look-ahead schedules weekly for the duration of commissioning.
2. Two-week look-ahead schedules shall identify the date, time, beginning location, Contractor personnel required, and anticipated duration for each startup or test activity.
3. Use two-week look-ahead schedules to notify and coordinate participation of Owner's witnesses.

D. Owner's Witness Coordination:

1. Coordinate Owner's witness participation via Architect.
2. Notify Architect of commissioning schedule changes at least [two] <Insert number> work days in advance for activities requiring the participation of Owner's witness.

### 3.9 COMMISSIONING REPORTS

A. Test Reports:

1. Pre-startup reports include observations of the conditions of installation, organized into the following sections:
  - a. Equipment Model Verification: Compare contract requirements, approved submittals, and provided equipment. Note inconsistencies.
  - b. Preinstallation Physical Condition Checks: Observe physical condition of equipment prior to installation. Note conditions including, but not limited to, physical damage, corrosion, water damage, or other contamination or dirt.
  - c. Preinstallation Component Verification Checks: Verify components supplied with the equipment, preinstalled or field installed, are correctly installed and functional. Verify external components required for proper operation of equipment correctly installed and functional. Note missing, improperly configured, improperly installed, or nonfunctional components.
  - d. Summary of Installation Compliance Issues and Corrective Actions: Identify installation compliance issues and the corrective actions for each. Verify that issues noted have been corrected.
  - e. Evaluation of System Readiness for Startup: For each item of equipment for each system for which startup is anticipated, document in summary form acceptable to Owner completion of equipment model verification, preinstallation physical condition checks, preinstallation component verification checks, and completion of corrective actions for installation compliance issues.
2. Test data reports include the following:
  - a. "As-tested" system configuration. Complete record of conditions under which the test was performed, including, but not limited to, the status of equipment, systems, and assemblies; temporary adjustments and settings; and ambient conditions.
  - b. Data and observations, including, but not limited to, data trend logs, recorded during the tests.
  - c. Signatures of individuals performing and witnessing tests.

- d. Data trend logs accumulated overnight from the previous day of testing.
3. Commissioning Compliance Issues Reports: Report as commissioning compliance issues results of tests and test demonstrations that do not comply with acceptance criteria. Report only one issue per commissioning compliance issue report. Use sequentially numbered facsimiles of commissioning compliance issue report form included in this Section, or other form approved by Owner. Distribute commissioning compliance issue reports to parties responsible for taking corrective action. Identify the following:
    - a. Commissioning compliance issue report number. Assign unique, sequential numbers to individual commissioning compliance issue reports when they are created, to be used for tracking.
    - b. Action distribution list.
    - c. Report date.
    - d. Test number and description.
    - e. Equipment identification and location.
    - f. Briefly describe observations about the performance associated with failure to achieve acceptable results. Identify the cause of failure if apparent.
    - g. Diagnostic procedure or plan to determine the cause (include in initial submittal).
    - h. Diagnosis of fundamental cause of issues as specified below (include in resubmittal).
    - i. Fundamental cause of unacceptable performance as determined by diagnostic tests and activities.
    - j. When issues have been resolved, update and resubmit the commissioning issue report forms by completing Part 2. Identify resolution taken and the dates and initials of the persons making the entries.
    - k. Schedule for retesting.
  4. Weekly progress reports include information for tests conducted since the preceding report and the following:
    - a. Completed data forms.
    - b. Equipment or system tested, including test number, system or equipment tag number and location, and notation about the apparent acceptability of results.
    - c. Activities scheduled but not conducted per schedule.
    - d. Commissioning compliance issue report log.
    - e. Schedule changes for remaining Commissioning-Process Work, if any.
  5. Data trend logs shall be initiated and running prior to the time scheduled for the test demonstration.
    - a. Trend log data format shall be multiple data series graphs. Where multiple data series are trend logged concurrently, present the data on a common horizontal time axis. Individual data series may be presented on a segmented vertical axis to avoid interference of one data series with another, and to accommodate different axis scale values. Graphs shall be sufficiently clear to interpret data within the accuracy required by the acceptance criteria.
    - b. Attach to the data form printed trend log data collected during the test or test demonstration.

- c. Record, print out, and attach to the data form operator activity during the time the trend log is running. During the time the trend log is running, operator intervention not directed by the test procedure invalidates the test results.
- 6. System Alarm Logs: Record and print out a log of alarms that occurred since the last log was printed. Evaluate alarms to determine if the previous day's work resulted in any conditions that are not considered "normal operation."
  - a. Conditions that are not considered "normal operation" shall be reported on a commissioning issue report attached to the alarm log. Resolve as necessary. The intent of this requirement is to discover control system points or sequences left in manual or disabled conditions, equipment left disconnected, set points left with abnormal values, or similar conditions that may have resulted from failure to fully restore systems to normal, automatic control after test completion.

### 3.10 CERTIFICATE OF CONSTRUCTION PHASE COMMISSIONING COMPLETION

- A. When Contractor considers that construction phase commissioning, or a portion thereof which Owner agrees to accept separately, is complete, Contractor shall prepare and submit to Owner and Commissioning Authority through Architect a comprehensive list of items to be completed or corrected. Failure to include an item on such list does not alter Contractor's responsibility to complete commissioning.
- B. On receipt of Contractor's list, Commissioning Authority will make an inspection to determine whether the construction phase commissioning or designated portion thereof is complete. If Commissioning Authority's inspection discloses items, whether included on Contractor's list, which is not sufficiently complete as defined in "Construction Phase Commissioning Completion" Paragraph in the "Definitions" Article, Contractor shall, before issuance of the Certificate of Construction Phase Completion, complete or correct such items on notification by Commissioning Authority. In such case, Contractor shall then submit a request for another inspection by Commissioning Authority to determine construction phase commissioning completion.
- C. Contractor shall promptly correct deficient conditions and issues discovered during commissioning. Costs of correcting such deficient conditions and issues, including additional testing and inspections, the cost of uncovering and replacement, and compensation for Architect's and Commissioning Authority's services and expenses made necessary thereby, shall be at Contractor's expense.
- D. When construction phase commissioning or designated portion is complete, Commissioning Authority will prepare a Certificate of Construction Phase Commissioning that shall establish the date of completion of construction phase commissioning. Certificate of Construction Phase Commissioning Completion shall be submitted prior to requesting inspection for determining date of Substantial Completion.

END OF SECTION 019113

## SECTION 02 41 19

### SELECTIVE DEMOLITION

#### PART 1 - GENERAL

##### 1.1 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.

##### 1.2 MATERIALS OWNERSHIP

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

##### 1.3 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Washington Union Station, 50 Massachusetts Ave NE, Washington, DC 20002.

##### 1.4 INFORMATIONAL SUBMITTALS

- A. Engineering Survey: Submit engineering survey of condition of building.
- B. 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.
- C. Schedule of selective demolition activities with starting and ending dates for each activity.
- D. Predemolition photographs or video.
- E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician.

##### 1.5 CLOSEOUT SUBMITTALS

- A. Inventory of items that have been removed and salvaged.

## 1.6 QUALITY ASSURANCE

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

## 1.7 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. Hazardous materials will be removed by Owner before start of the Work.
  - 2. 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.
- G. Arrange selective demolition schedule so as not to interfere with Owner's operations.

## 1.8 WARRANTY

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

## 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/ASSP 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. **Perform** an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.
- C. Inventory and record the condition of items to be removed and salvaged.

### 3.2 PREPARATION

- A. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction.

### 3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.
  - 1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
  - 2. Arrange to shut off utilities with utility companies.
  - 3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
  - 4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings 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 and leave in place.
    - 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 and leave in place.

### 3.4 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
- B. Temporary Shoring: Design, 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.
- C. Remove temporary barricades and protections where hazards no longer exist.

### 3.5 SELECTIVE DEMOLITION

- 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. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
  - 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  - 3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
  - 4. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  - 5. Dispose of demolished items and materials promptly. **Comply with requirements in Section 017419 "Construction Waste Management and Disposal."**
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Removed and Salvaged Items:
  - 1. Clean salvaged items.
  - 2. Pack or crate items after cleaning. Identify contents of containers.
  - 3. Store items in a secure area until delivery to Owner.
  - 4. Transport items to Owner's storage area **designated by Owner**.
  - 5. Protect items from damage during transport and storage.
- D. Removed and Reinstalled Items:
  - 1. Clean and repair items to functional condition adequate for intended reuse.
  - 2. Pack or crate items after cleaning and repairing. Identify contents of containers.

3. Protect items from damage during transport and storage.
  4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition **and cleaned** and reinstalled in their original locations after selective demolition operations are complete.

### 3.6 CLEANING

- A. Remove demolition waste materials from Project site **and recycle or dispose of them according to Section 017419 "Construction Waste Management and Disposal."**
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. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

**END OF SECTION 02 41 19**

## SECTION 03 30 53

### MISCELLANEOUS 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 reinforcement, concrete materials, mixture design, placement procedures, and finishes.

##### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture.

##### 1.4 QUALITY ASSURANCE

- A. Ready-Mix-Concrete 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.

#### PART 2 - PRODUCTS

##### 2.1 CONCRETE, GENERAL

- A. Comply with the following sections of ACI 301 (ACI 301M) unless modified by requirements in the Contract Documents:
  - 1. "General Requirements."
  - 2. "Formwork and Formwork Accessories."
  - 3. "Reinforcement and Reinforcement Supports."
  - 4. "Concrete Mixtures."
  - 5. "Handling, Placing, and Constructing."
  - 6. "Lightweight Concrete."
- B. Comply with ACI 117 (ACI 117M).

##### 2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

- B. Plain-Steel Wire: ASTM A 1064/A 1064M, as drawn.
- C. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.
- D. Deformed-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, flat sheet.

#### CONCRETE MATERIALS

- E. 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.
- F. Cementitious Materials:
  - 1. Portland Cement: ASTM C 150/C 150M, Type I.
  - 2. Fly Ash: ASTM C 618, Class C or F.
  - 3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
- G. Normal-Weight Aggregate: ASTM C 33/C 33M, **1-1/2-inch (38-mm)** nominal maximum aggregate size.
- H. Lightweight Aggregate: ASTM C 330/C 330M, **1-inch (25-mm)** nominal maximum aggregate size.
- I. Air-Entraining Admixture: ASTM C 260/C 260M.
- J. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
  - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
  - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
  - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
  - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
  - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
  - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.
- K. Water: ASTM C 94/C 94M.

#### 2.3 RELATED MATERIALS

- A. Vapor Retarder: Plastic sheet, ASTM E 1745, Class A or B.
- B. Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils (0.25 mm) thick; or plastic sheet, ASTM E 1745, Class C.
- C. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.

## 2.4 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth or cotton mats.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
- F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

## 2.5 CONCRETE MIXTURES

- A. Comply with ACI 301 (ACI 301M).
- B. Normal-Weight Concrete:
  - 1. Minimum Compressive Strength: 3000 psi (20.7 MPa) at 28 days.
  - 2. Maximum W/C Ratio: 0.40.
  - 3. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
  - 4. Slump Limit: [4 inches (100 mm)] [5 inches (125 mm)] [8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture] <Insert dimension>, plus or minus 1 inch (25 mm).
  - 5. Air Content: Maintain within range permitted by ACI 301 (ACI 301M). Do not allow air content of trowel-finished floor slabs to exceed 3 percent.
- C. Structural Lightweight Concrete Mix: ASTM C 330/C 330M, proportioned to produce concrete with a minimum compressive strength of 3000 psi (20.7 MPa) at 28 days and a calculated equilibrium unit weight of 110 lb/cu. ft. (1762 kg/cu. m) >plus or minus 3 lb/cu. ft. (48.1 kg/cu. m), as determined by ASTM C 567/C 567M. Concrete slump at point of placement shall be the minimum necessary for efficient mixing, placing, and finishing.
  - 1. Limit slump to 5 inches (125 mm) for troweled slabs and 4 inches (100 mm) for other slabs.
- D. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than a rate of 1.0 lb/cu. yd. (0.60 kg/cu. m).

## 2.6 CONCRETE MIXING

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

1. When air temperature is above 90 deg F (32 deg C), 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. (0.76 cu. m) 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. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
  3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

### **PART 3 - EXECUTION**

#### **3.1 FORMWORK INSTALLATION**

- A. Design, construct, erect, brace, and maintain formwork according to ACI 301 (ACI 301M).

#### **3.2 EMBEDDED ITEM INSTALLATION**

- 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.

#### **3.3 VAPOR-RETARDER INSTALLATION**

- A. Install, protect, and repair vapor retarders according to ASTM E 1643; place sheets in position with longest dimension parallel with direction of pour.
  1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended adhesive or joint tape.

#### **3.4 STEEL REINFORCEMENT INSTALLATION**

- A. Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
  1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

#### **3.5 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.

### 3.6 CONCRETE PLACEMENT

- A. Comply with ACI 301 (ACI 301M) for placing concrete.
- B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301 (ACI 301M).
- C. Do not add water to concrete during delivery, at Project site, or during placement.
- D. Consolidate concrete with mechanical vibrating equipment according to ACI 301 (ACI 301M).
- E. Equipment Bases, Curbs and Foundations:
  - 1. Coordinate sizes and locations of concrete bases with actual equipment provided.
  - 2. Construct concrete bases **6 inches (150 mm)]** high unless otherwise indicated; and extend base not less than 6 inches (150 mm) in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated or unless required for seismic anchor support.
  - 3. Minimum Compressive Strength: **[5000 psi (34.5 MPa)] [4500 psi (31 MPa)] [4000 psi (27.6 MPa)] [3500 psi (24.1 MPa)] [3000 psi (20.7 MPa)]** at 28 days.
  - 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
  - 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base, and anchor them into structural concrete substrate.
  - 6. Prior to pouring concrete, place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

### 3.7 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 exceeding 1/2 inch (13 mm).
  - 1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch (3 mm).
  - 1. Apply to concrete surfaces exposed to public view, or to be covered with a coating or covering material applied directly to concrete.
- C. Rubbed Finish: Apply the following rubbed finish, defined in ACI 301 (ACI 301M), to smooth-formed-finished as-cast concrete where indicated:
  - 1. Smooth-rubbed finish.

2. Grout-cleaned finish.
  3. Cork-floated finish.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

### 3.8 FINISHING UNFORMED SURFACES

- A. General: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on surface.
1. Do not further disturb surfaces before starting finishing operations.
- C. Scratch Finish: Apply scratch finish to surfaces indicated and surfaces to receive concrete floor topping or mortar setting beds for ceramic or quarry tile, portland cement terrazzo, and other bonded cementitious floor finishes unless otherwise indicated.
- D. Float Finish: Apply float finish to surfaces indicated, to surfaces to receive trowel finish, and to floor and slab surfaces to be covered with fluid-applied or sheet waterproofing, fluid-applied or direct-to-deck-applied membrane roofing, or sand-bed terrazzo.
- E. Trowel Finish: Apply a hard trowel finish to surfaces indicated and to floor and slab surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin film-finish coating system.
- F. Trowel and Fine-Broom Finish: Apply a partial trowel finish, stopping after second troweling, to surfaces indicated and to surfaces where ceramic or quarry tile is to be installed by either thickset or thinset methods. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with a fine broom.
- G. Slip-Resistive Broom Finish: Apply a slip-resistive finish to surfaces indicated and to exterior concrete platforms, steps, and ramps. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.

### 3.9 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 with ACI 301 (ACI 301M) for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to 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. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- D. Curing Methods: Cure formed and unformed concrete for at least seven days by one or a combination of the following methods:
  - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
  - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
  - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
  - 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

### 3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Tests: Perform according to ACI 301 (ACI 301M).
  - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
  - 2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mixture placed each day.

**END OF SECTION 03 30 53**

## SECTION 07 84 13

### PENETRATION FIRESTOPPING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section Includes:

- 1. Penetrations in fire-resistance-rated walls.
- 2. Penetrations in horizontal assemblies.

- B. Related Requirements:

- 1. Section 078443 "Joint Firestopping" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

##### 1.3 ALLOWANCES

- A. Penetration firestopping Work is part of an allowance.

##### 1.4 UNIT PRICES

- A. Work of this Section is affected by unit prices.

##### 1.5 ACTION SUBMITTALS

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

- B. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.

- 1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

##### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

- B. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

#### 1.7 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

#### 1.8 QUALITY ASSURANCE

- A. Option 1: Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."
- B. Option 2: A firm with two years minimum experience in installing penetration firestopping systems, who employs at least one individual with a demonstrated knowledge of the FCIA Firestop Manual of Practice, and is approved by the penetration firestopping manufacturer to install their products.

#### 1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

#### 1.10 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

### **PART 2 - PRODUCTS**

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
  - 1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
  - 2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:

- a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.
  - 1) UL in its "Fire Resistance Directory."
  - 2) Intertek Group in its "Directory of Listed Building Products."
  - 3) FM Global in its "Building Materials Approval Guide."

## 2.2 PENETRATION FIRESTOPPING SYSTEMS

- A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. 3M Fire Protection Products.
    - b. Hilti, Inc.
    - c. Nelson Firestop Products.
    - d. Specified Technologies, Inc.
    - e. Tremco, Inc.
- B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
  - 1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg (2.49 Pa).
  - 1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
  - 2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
  - 3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.
- D. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E 84.
- E. VOC Content: Sealants and sealant primers shall comply with the following:
  - 1. Sealant shall have a VOC content of 250 g/L or less.
  - 2. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers," CDPH standard method version 1.2.
- F. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components

specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.

1. Permanent forming/damming/backing materials.
2. Substrate primers.
3. Collars.
4. Steel sleeves.

## 2.3 FILL MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced intumescent elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.
- K. Fire Rated Cable Management Devices: Factory-assembled round metallic sleeve device for use with cable penetrations, containing an integrated smoke seal fabric membrane that can be opened and closed for re-penetration.
- L. Drop-In Firestop Devices: Factory-assembled devices for use with combustible or noncombustible penetrants in cored holes within concrete floors. Device shall consist of galvanized steel sleeve lined with an intumescent strip, an extended rectangular flange attached to one end for fastening to concrete floor, and neoprene gasket.

- M. Blocks/Plugs: Intumescent flexible block/plug suitable for reuse in re-penetration of openings. Blocks shall allow up to 12-inches of unreinforced annular space.

## 2.4 MIXING

- A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

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

### 3.2 PREPARATION

- A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:
  - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping materials.
  - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
  - 3. Remove laitance and form-release agents from concrete.
- B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

### 3.3 INSTALLATION

- A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.

1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.
- C. Install fill materials by proven techniques to produce the following results:
1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
  2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
  3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

### 3.4 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches (76 mm) high and with minimum 0.375-inch (9.5-mm) strokes.
1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet (4.57 m) from end of wall and at intervals not exceeding 30 feet (9.14 m).
- B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
  2. Contractor's name, address, and phone number.
  3. Designation of applicable testing and inspecting agency.
  4. Date of installation.
  5. Manufacturer's name.
  6. Installer's name.

### 3.5 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E 2174.
- B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.
- C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

### 3.6 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion.

### 3.7 PENETRATION FIRESTOPPING SYSTEM SCHEDULE

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHEZ.
- B. Where Intertek Group-listed systems are indicated, they refer to design numbers in Intertek Group's "Directory of Listed Building Products" under "Firestop Systems."
- C. Where FM Global-approved systems are indicated, they refer to design numbers listed in FM Global's "Building Materials Approval Guide" under "Wall and Floor Penetration Fire Stops."
- D. Penetration Firestopping Systems with No Penetrating Items FS-01:
  - 1. UL-Classified Systems: C-AJ-0001-0999.
  - 2. Intertek Group-Listed Systems: As Indicated.
  - 3. FM Global-Approved Systems: As Indicated.
  - 4. F-Rating: 2 hours
  - 5. T-Rating: 2 hours.
  - 6. L-Rating at Ambient: Less than 5.0 cfm per square foot of penetration opening for each through-penetration firestop system, or a total cumulative leakage of 50 cfm for any 100 square feet of wall area or floor area.
  - 7. L-Rating at 400 Deg F (204 Deg C): Less than 5.0 cfm per square foot of penetration opening for each through-penetration firestop system, or a total cumulative leakage of 50 cfm for any 100 square feet of wall area or floor area.
  - 8. W-Rating: No leakage of water at completion of water leakage testing.
  - 9. Type of Fill Materials: One of the following:
    - a. Latex sealant.
    - b. Silicone sealant.
    - c. Intumescent putty.
- E. Penetration Firestopping Systems for Metallic Pipes, Conduit, or Tubing FS-02:
  - 1. UL-Classified Systems: C-AJ-0001-0999.
  - 2. Intertek Group-Listed Systems: As Indicated.
  - 3. FM Global-Approved Systems: As Indicated.
  - 4. F-Rating: 2 hours.
  - 5. T-Rating: 2 hours.
  - 6. L-Rating at Ambient: Less than 5.0 cfm per square foot of penetration opening for each through-penetration firestop system, or a total cumulative leakage of 50 cfm for any 100 square feet of wall area or floor area.

7. L-Rating at 400 Deg F (204 Deg C): Less than 5.0 cfm per square foot of penetration opening for each through-penetration firestop system, or a total cumulative leakage of 50 cfm for any 100 square feet of wall area or floor area.
8. W-Rating: No leakage of water at completion of water leakage testing.
9. Type of Fill Materials: One of the following:
  - a. Latex sealant.
  - b. Silicone sealant.
  - c. Intumescent putty.
  - d. Firestop device.

F. Penetration Firestopping Systems for Nonmetallic Pipe, Conduit, or Tubing FS-03:

1. UL-Classified Systems: C-AJ-2001-2999.
2. Intertek Group-Listed Systems: As indicated.
3. FM Approval-Approved Systems: As indicated.
4. F-Rating: 2 hours.
5. T-Rating: 2 hours.
6. L-Rating at Ambient: Less than 5.0 cfm per square foot of penetration opening for each through-penetration firestop system, or a total cumulative leakage of 50 cfm for any 100 square feet of wall area or floor area.
7. L-Rating at 400 Deg F: Less than 5.0 cfm per square foot of penetration opening for each through-penetration firestop system, or a total cumulative leakage of 50 cfm for any 100 square feet of wall area or floor area.
8. W-Rating: No leakage of water at completion of water leakage testing.
9. Type of Fill Materials: One of the following:
  - a. Latex sealant.
  - b. Silicone sealant.
  - c. Intumescent putty.
  - d. Intumescent wrap strips.
  - e. Firestop device.

G. Penetration Firestopping Systems for Electrical Cables FS-04:

1. UL-Classified Systems: C-AJ-3001-3999.
2. Intertek Group-Listed Systems As indicated.
3. FM Global-Approved Systems: As indicated.
4. F-Rating: 2 hours.
5. T-Rating: 2 hours.
6. L-Rating at Ambient: Less than 5.0 cfm per square foot of penetration opening for each through-penetration firestop system, or a total cumulative leakage of 50 cfm for any 100 square feet of wall area or floor area.
7. L-Rating at 400 Deg F: Less than 5.0 cfm per square foot of penetration opening for each through-penetration firestop system, or a total cumulative leakage of 50 cfm for any 100 square feet of wall area or floor area.
8. W-Rating: No leakage of water at completion of water leakage testing.
9. Type of Fill Materials: One of the following:
  - a. Latex sealant.
  - b. Silicone sealant.
  - c. Intumescent putty.
  - d. Silicone foam.
  - e. Pillows/bags.
  - f. Firestop device.
  - g. Firestop blocks/plugs.

H. Penetration Firestopping Systems for Insulated Pipes FS-05:

1. UL-Classified Systems: C-AJ-5001-5999.
2. Intertek Group-Listed Systems As indicated.
3. FM Global-Approved Systems: As indicated.
4. F-Rating: 2 hours.
5. T-Rating: 2 hours.
6. L-Rating at Ambient: Less than 5.0 cfm per square foot of penetration opening for each through-penetration firestop system, or a total cumulative leakage of 50 cfm for any 100 square feet of wall area or floor area.
7. L-Rating at 400 Deg F: Less than 5.0 cfm per square foot of penetration opening for each through-penetration firestop system, or a total cumulative leakage of 50 cfm for any 100 square feet of wall area or floor area.
8. W-Rating: No leakage of water at completion of water leakage testing.
9. Type of Fill Materials: One of the following:
  - a. Latex sealant.
  - b. Silicone sealant.
  - c. Intumescent putty.
  - d. Silicone foam.
  - e. Pillows/bags.
  - f. Firestop device.
  - g. Firestop blocks/plugs

I. Penetration Firestopping Systems for Miscellaneous Electrical Penetrants FS-06:

1. UL-Classified Systems: C-AJ-6001-6999.
2. Intertek Group-Listed Systems As indicated.
3. FM Global-Approved Systems: As indicated.
4. F-Rating: 2 hours.
5. T-Rating: 2 hours.
6. L-Rating at Ambient: Less than 5.0 cfm per square foot of penetration opening for each through-penetration firestop system, or a total cumulative leakage of 50 cfm for any 100 square feet of wall area or floor area.
7. L-Rating at 400 Deg F: Less than 5.0 cfm per square foot of penetration opening for each through-penetration firestop system, or a total cumulative leakage of 50 cfm for any 100 square feet of wall area or floor area.
8. W-Rating: No leakage of water at completion of water leakage testing.
9. Type of Fill Materials: One of the following:
  - a. Latex sealant.
  - b. Silicone sealant.
  - c. Intumescent putty.
  - d. Firestop device.
  - e. Firestop blocks/plugs

J. Penetration Firestopping Systems for Miscellaneous Mechanical Penetrants FS-07:

1. UL-Classified Systems: C-AJ-7001-7999.
2. Intertek Group-Listed Systems As indicated.
3. FM Global-Approved Systems: As indicated.
4. F-Rating: 2 hours.
5. T-Rating: 2 hours.
6. L-Rating at Ambient: Less than 5.0 cfm per square foot of penetration opening for each through-penetration firestop system, or a total cumulative leakage of 50 cfm for any 100 square feet of wall area or floor area.

7. L-Rating at 400 Deg F: Less than 5.0 cfm per square foot of penetration opening for each through-penetration firestop system, or a total cumulative leakage of 50 cfm for any 100 square feet of wall area or floor area.
8. W-Rating: No leakage of water at completion of water leakage testing.
9. Type of Fill Materials: One of the following:
  - a. Latex sealant.
  - b. Silicone sealant.

K. Penetration Firestopping Systems for Groupings of Penetrants FS-08:

1. UL-Classified Systems: C-AJ-8001-8999.
2. Intertek Group-Listed Systems As indicated.
3. FM Global-Approved Systems: As indicated.
4. F-Rating: 2 hours.
5. T-Rating: 2 hours.
6. L-Rating at Ambient: Less than 5.0 cfm per square foot of penetration opening for each through-penetration firestop system, or a total cumulative leakage of 50 cfm for any 100 square feet of wall area or floor area.
7. L-Rating at 400 Deg F: Less than 5.0 cfm per square foot of penetration opening for each through-penetration firestop system, or a total cumulative leakage of 50 cfm for any 100 square feet of wall area or floor area.
8. W-Rating: No leakage of water at completion of water leakage testing.
9. Type of Fill Materials: One of the following:
  - a. Latex sealant.
  - b. Silicone sealant.
  - c. Intumescent wrap strips.
  - d. Firestop device.
  - e. Intumescent composite sheet.
  - f. Firestop blocks/plugs.

**END OF SECTION 07 84 13**

**SECTION 07 84 33**  
**JOINT FIRESTOPPING**

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

- 1. Joints in or between fire-resistance-rated constructions.

B. Related Requirements:

- 1. Section 078413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers and for wall identification.
- 2. Section 079513.13 "Interior Expansion Joint Cover Assemblies" for fire-resistive manufactured expansion-joint cover assemblies for interior floors, walls, and ceilings.
- 3. Section 079513.16 "Exterior Expansion Joint Cover Assemblies" for fire-resistive manufactured expansion-joint cover assemblies for exterior building walls, soffits, and parapets.
- 4. Section 092216 "Non-Structural Metal Framing" for firestop tracks for metal-framed partition heads.

C. Single Subcontract Responsibilities:

- 1. Refer to Section 084413 "Window and Curtain Walls" for requirements of single subcontract responsibilities for perimeter fire-resistive joint systems used in conjunction with window and curtain walls.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

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

- B. Shop Drawings: For each joint firestopping system, show each kind of construction condition in which joints are installed; also show relationships to adjoining construction. Include joint firestopping system design designation of testing and inspecting agency

acceptable to authorities having jurisdiction that demonstrates compliance with requirements for each condition indicated.

- C. Product Schedule: For each joint each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.
  - 1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each joint firestopping system, for tests performed by a qualified testing agency.

## 1.6 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

## 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Installer shall comply with the qualifications in Option 1 or Option 2 as follows:
  - 1. Option 1: Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."
  - 2. Option 2: A firm with two years' minimum experience in installing joint firestopping systems, who employs at least one individual with a demonstrated knowledge of the FCIA Firestop Manual of Practice and is approved by the joint firestopping manufacturer to install their products.

## 1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation

## 1.9 COORDINATION

- A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate the sizing of joints to accommodate joint firestopping systems.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
  - 1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
  - 2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
  - 3. Joint firestopping systems shall bear classification marking of a qualified testing agency.
    - a. UL in its "Fire Resistance Directory."
    - b. Intertek Group in its "Directory of Listed Building Products."
    - c. FM Global in its "Building Materials Approval Guide."

### 2.2 JOINT FIRESTOPPING SYSTEMS

- A. Joint Firestopping Systems: Systems that resist the spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
- B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E1966 or UL 2079.
- C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. 3M Fire Protection Products.
  - b. A/D Fire Protection Systems Inc.
  - c. Hilti, Inc.
  - d. Nelson Firestop; a brand of Emerson Industrial Automation.
  - e. RectorSeal.
  - f. Rockwool International.
  - g. Specified Technologies, Inc.
  - h. Thermafiber, Inc.; an Owens Corning company.
  - i. Tremco, Inc.
- 1. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.
- A. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.
    - 1. Sealant shall have a VOC content of 250 g/L or less.
    - 2. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers," CDPH standard method version 1.2.
  - B. Accessories: Provide components of joint firestopping systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain the required ratings. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

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

### 3.2 PREPARATION

- A. Surface Cleaning: Before installing joint firestopping systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
  - 1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
  - 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
  - 3. Remove laitance and form-release agents from concrete.

- B. Prime substrates where recommended in writing by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

### 3.3 INSTALLATION

- A. General: Install joint firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
  - 1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.
- C. Install elastomeric fill materials for joint firestopping systems by proven techniques to produce the following results:
  - 1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire- resistance ratings indicated.
  - 2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
  - 3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

### 3.4 IDENTIFICATION

- A. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
  - 1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
  - 2. Contractor's name, address, and phone number.
  - 3. Designation of applicable testing agency.
  - 4. Date of installation.
  - 5. Manufacturer's name.
  - 6. Installer's name.

### 3.5 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E2393.
- B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.
- C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

### 3.6 CLEANING AND PROTECTION

- A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.
- B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated joint firestopping systems immediately and install new materials to produce joint firestopping systems complying with specified requirements.

### 3.7 JOINT FIRESTOPPING SYSTEM SCHEDULE

- A. Where UL-classified systems are indicated, they refer to system numbers in UL's "Fire Resistance Directory" under product Category XHBN or Category XHDG.
- B. Where Intertek Group-listed systems are indicated, they refer to design numbers in Intertek Group's "Directory of Listed Building Products" under product category Expansion/Seismic Joints or Firestop Systems.
- C. Where FM Approval-approved systems are indicated, they refer to design numbers listed in FM Approval's "Approval Guide."
- D. Floor-to-Floor, Joint Firestopping Systems FRJS-01:
  - 1. UL-Classified Systems: FF-D-0000-0999.
  - 2. Intertek Group-Listed Systems: As indicated.
  - 3. FM Approval-Approved Systems: As indicated.
  - 4. Assembly Rating: Hour rating equal to or exceeding the fire-resistance rating of the floor.
  - 5. Nominal Joint Width: As indicated, but less than or equal to 2 inches.
  - 6. Movement Capabilities: Class II - 25 percent compression or extension, unless otherwise indicated.
  - 7. L-Rating at Ambient: Less than 5.0 cfm per square foot of penetration opening for

each through- penetration firestop system, or a total cumulative leakage of 50 cfm for any 100 square feet of wall area or floor area.

8. L-Rating at 400 Deg F: Less than 5.0 cfm per square foot of penetration opening for each through- penetration firestop system, or a total cumulative leakage of 50 cfm for any 100 square feet of wall area or floor area.
9. W-Rating: No leakage of water at completion of water leakage testing.

E. Wall-to-Wall, Joint Firestopping Systems FRJS-02:

1. UL-Classified Systems: WW-D-0000-0999.
2. Intertek Group-Listed Systems: As indicated.
3. FM Approval-Approved Systems: As indicated.
4. Assembly Rating: Hour rating equal to or exceeding the fire-resistance rating of the wall.
5. Nominal Joint Width: As indicated, but less than or equal to 2 inches.
6. Movement Capabilities: Class II - 25 percent compression or extension, unless otherwise indicated.
7. L-Rating at Ambient: Less than 5.0 cfm per square foot of penetration opening for each through- penetration firestop system, or a total cumulative leakage of 50 cfm for any 100 square feet of wall area or floor area.
8. L-Rating at 400 Deg F: Less than 5.0 cfm per square foot of penetration opening for each through- penetration firestop system, or a total cumulative leakage of 50 cfm for any 100 square feet of wall area or floor area.

F. Floor-to-Wall, Joint Firestopping Systems FRJS-03:

1. UL-Classified Systems: FW-D-0000-0999.
2. Intertek Group-Listed Systems: As indicated.
3. FM Approval-Approved Systems: As indicated.
4. Assembly Rating: Hour rating equal to or exceeding the fire-resistance rating of the wall.
5. Nominal Joint Width: As indicated, but less than or equal to 2 inches.
6. Movement Capabilities: Class II - 25 percent compression or extension, unless otherwise indicated.
7. L-Rating at Ambient: Less than 5.0 cfm per square foot of penetration opening for each through- penetration firestop system, or a total cumulative leakage of 50 cfm for any 100 square feet of wall area or floor area.
8. L-Rating at 400 Deg F: Less than 5.0 cfm per square foot of penetration opening for each through- penetration firestop system, or a total cumulative leakage of 50 cfm for any 100

square feet of wall area or floor area.

G. Head-of-Wall, Fire-Resistive Joint Firestopping Systems FRJS-04:

1. UL-Classified Systems: HW-D-0000-0999.
2. Intertek Group-Listed Systems: As indicated.
3. FM Approval-Approved Systems: As indicated.
4. Assembly Rating: Hour rating equal to or exceeding the fire-resistance rating of the wall.
5. Nominal Joint Width: As indicated, but less than or equal to 2 inches.
6. Movement Capabilities: Class II - 50 percent compression or extension, unless otherwise indicated.
7. L-Rating at Ambient: Less than 5.0 cfm per square foot of penetration opening for each through- penetration firestop system, or a total cumulative leakage of 50 cfm for any 100 square feet of wall area or floor area.
8. L-Rating at 400 Deg F: Less than 5.0 cfm per square foot of penetration opening for each through- penetration firestop system, or a total cumulative leakage of 50 cfm for any 100 square feet of wall area or floor area.

H. Bottom-of-Wall, Joint Firestopping Systems FRJS-05:

1. UL-Classified Systems: BW-D-0000-0999.
2. Intertek Group-Listed Systems: As indicated.
3. FM Approval-Approved Systems: As indicated.
4. Assembly Rating: Hour rating equal to or exceeding the fire-resistance rating of the wall.
5. Nominal Joint Width: As indicated, but less than or equal to 2 inches.
6. Movement Capabilities: Class II - 25 percent compression or extension, unless otherwise indicated.
7. L-Rating at Ambient: Less than 5.0 cfm per square foot of penetration opening for each through- penetration firestop system, or a total cumulative leakage of 50 cfm for any 100 square feet of wall area or floor area.
8. L-Rating at 400 Deg F: Less than 5.0 cfm per square foot of penetration opening for each through- penetration firestop system, or a total cumulative leakage of 50 cfm for any 100 square feet of wall area or floor area.

I. Wall-to-Wall, Joint Firestopping Systems Intended for Use as Corner Guards FRJS-06:

1. UL-Classified Systems: CG-D-0000-0999.

2. Intertek Group-Listed Systems: As indicated.
3. FM Approval-Approved Systems: As indicated.
4. Assembly Rating: Hour rating equal to or exceeding the fire-resistance rating of the wall.
5. Nominal Joint Width: As indicated, but less than or equal to 2 inches.
6. Movement Capabilities: Class II - 25 percent compression or extension, unless otherwise indicated.
7. L-Rating at Ambient: Less than 5.0 cfm per square foot of penetration opening for each through- penetration firestop system, or a total cumulative leakage of 50 cfm for any 100 square feet of wall area or floor area.
8. L-Rating at 400 Deg F: Less than 5.0 cfm per square foot of penetration opening for each through- penetration firestop system, or a total cumulative leakage of 50 cfm for any 100 square feet of wall area or floor area.

### **JOINT FIRESTOPPING 07 84 33**

## SECTION 07 92 00

### JOINT SEALANTS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section Includes:

1. Silicone joint sealants.
2. Urethane joint sealants.
3. Silyl-terminated polyether joint sealants.
4. Mildew-resistant joint sealants.
5. Polysulfide joint sealants.
6. Butyl joint sealants.
7. Latex joint sealants.

- B. Related Requirements:

1. Section 079100 "Preformed Joint Seals" for preformed compressible foam and precured joint seals.
2. Section 079219 "Acoustical Joint Sealants" for sealing joints in sound-rated construction.
3. Section 321373 "Concrete Paving Joint Sealants" for sealing joints in paved roads, parking lots, walkways, and curbing.

##### 1.3 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.

- B. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

##### 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.

- B. Product Test Reports: For each kind of joint sealant, for tests performed by manufacturer and witnessed by a qualified testing agency.

- C. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and substrate material to be tested:
  - 1. Joint-sealant location and designation.
  - 2. Manufacturer and product name.
  - 3. Type of substrate material.
  - 4. Proposed test.
  - 5. Number of samples required.
- D. Preconstruction Laboratory 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 are needed for adhesion.
- E. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.
- F. Field-Adhesion-Test Reports: For each sealant application tested.
- G. Sample Warranties: For special warranties.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Product Testing: Test joint sealants using a qualified testing agency.
  - 1. Testing Agency Qualifications: Qualified according to ASTM C 1021 to conduct the testing indicated.
- C. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

#### 1.6 FIELD CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
  - 2. When joint substrates are wet.
  - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
  - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

## 1.7 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
  - 1. Warranty Period: **Two** years from date of Substantial Completion.
- B. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
  - 1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
  - 2. Disintegration of joint substrates from causes exceeding design specifications.
  - 3. Mechanical damage caused by individuals, tools, or other outside agents.
  - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

## PART 2 - PRODUCTS

### 2.1 JOINT SEALANTS, GENERAL

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

### 2.2 NONSTAINING SILICONE JOINT SEALANTS

- A. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

### 2.3 SILYL-TERMINATED POLYETHER (STPE) JOINT SEALANTS

- A. STPE, S, NS, 50, NT: Single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, silyl-terminated polyether joint sealant; ASTM C 920, Type S, Grade NS, Class 50, Use NT.

### 2.4 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) or any of the preceding types, as approved in writing by joint-sealant manufacturer

for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

## 2.5 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

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

### 3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
  - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
  - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
    - a. Concrete.
    - b. Masonry.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
  - a. Metal.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### 3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
  1. Do not leave gaps between ends of sealant backings.
  2. Do not stretch, twist, puncture, or tear sealant backings.
  3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
  1. Place sealants so they directly contact and fully wet joint substrates.
  2. Completely fill recesses in each joint configuration.
  3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
  1. Remove excess sealant from surfaces adjacent to joints.
  2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

### 3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
  1. Extent of Testing: Test completed and cured sealant joints as follows:
    - a. Perform one test for each **1000 feet (300 m)** of joint length thereafter or one test per each floor per elevation.
  2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
    - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
  3. Inspect tested joints and report on the following:
    - a. Whether sealants filled joint cavities and are free of voids.
    - b. Whether sealant dimensions and configurations comply with specified requirements.
    - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
  4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
  5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

### 3.5 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

### 3.6 PROTECTION

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

### 3.7 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.
  - 1. Joint Locations:
    - a. Construction joints in cast-in-place concrete.
    - b. Control and expansion joints in unit masonry.
    - c. Perimeter joints between materials listed above and frames of doors and louvers.
    - d. Control and expansion joints in ceilings and walls.
    - e. Other joints as indicated on Drawings.
  - 2. Joint Sealant: STPE, S, NS, 50, NT
  - 3. Joint-Sealant Color: As indicated by manufacturer's designations.
- B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.
  - 1. Joint Locations:
    - a. Control joints on exposed interior surfaces of exterior walls.
    - b. Perimeter joints between interior wall surfaces and frames of interior doors and louvers.
    - c. Other joints as indicated on Drawings.
  - 2. Joint Sealant: STPE, S, NS, 50, NT.
  - 3. Joint-Sealant Color: As indicated by manufacturer's designations.

**END OF SECTION 07 92 00**

## SECTION 08 91 19

### FIXED LOUVERS

#### 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. Fixed, extruded-aluminum louvers.

##### 1.3 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades (i.e., the axes of the blades are horizontal).
- C. Vertical Louver: Louver with vertical blades (i.e., the axes of the blades are vertical).
- D. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.
- E. Wind-Driven-Rain-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

##### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.
- B. Shop Drawings: For louvers and accessories. Include plans, elevations, sections, details, and attachments to other work. Show frame profiles and blade profiles, angles, and spacing.
  - 1. Show weep paths, gaskets, flashing, sealant, and other means of preventing water intrusion.
  - 2. Show mullion profiles and locations.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: Based on evaluation of comprehensive tests performed according to AMCA 500-L by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for each type of louver and showing compliance with performance requirements specified.
- B. Sample warranties.

## 1.1 WARRANTY

- A. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of baked enamel, powder coat, or organic finishes within specified warranty period.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

## 1.2 FIELD CONDITIONS

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

## **PART 2 - PRODUCTS**

### 2.1 MANUFACTURERS

- A. Source Limitations: Obtain louvers from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

### 2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Louvers shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures shall be considered to act normal to the face of the building.
  - 1. Wind Loads: Determine loads based on pressures as indicated on Drawings.
  - 2. Wind Loads: Determine loads based on a uniform pressure of 30 lbf/sq. ft. (1436 Pa) acting inward or outward.
- B. Windborne-Debris-Impact Resistance: Louvers located within 30 feet (9.1 m) of grade shall pass basic-protection, large-missile testing requirements in ASTM E 1996 for Wind Zone 2 when tested according to ASTM E 1886. Test specimens shall be no smaller in width and length than louvers indicated for use on Project.

- C. Louver Performance Ratings: Provide louvers complying with requirements specified, as demonstrated by testing manufacturer's stock units identical to those provided, except for length and width according to AMCA 500-L.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient.
- E. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

### 2.3 FIXED, EXTRUDED-ALUMINUM LOUVERS

- A. Products:
  - 1. Basis of Design: Architectural Louvers model E2Js – 2" Deep 45 Degree Standard J Blade Extruded Aluminum Station Louvers
  - 2. Substitutions: Permitted
- B. Horizontal Non-drainable-Blade Louver, Extruded Aluminum:
  - 1. Louver Depth: 2 inches
  - 2. Blade Profile: Plain blade without center baffle.
  - 3. Frame and Blade Nominal Thickness: Not less than 0.060 inch for blades and for frames.
  - 4. Mullion Type: Fully recessed.
  - 5. Louver Performance Ratings:
    - a. Free Area: Not less than 54%.
    - b. Point of Beginning Water Penetration: Not less than 700 fpm (3.6 m/s).
    - c. Air Performance: Not more than 0.10-inch wg (25-Pa) pressure drop at 800-fpm (4.0-m/s) free-area intake velocity.

### 2.4 LOUVER SCREENS

- A. General: Provide screen at each exterior louver.
  - 1. Screen Location for Fixed Louvers: Interior face.
  - 2. Screening Type: Insect screening.
- B. Louver Screen Frames: Same type and form of metal as indicated for louver to which screens are attached.
- C. Louver Screening for Aluminum Louvers:
  - 1. Insect Screening, Aluminum: 18-by-16 (1.4-by-1.6-mm) mesh, 0.012-inch (0.30-mm) wire.

### 2.5 BLANK-OFF PANELS

- A. Uninsulated, Blank-Off Panels: Metal sheet attached to back of louver.
  - 1. Aluminum sheet for aluminum louvers, not less than 0.050-inch (1.27-mm) nominal thickness.
  - 2. Panel Finish: Same finish applied to louvers.

3. Attach blank-off panels with sheet metal screws.

## 2.6 MATERIALS

- A. Aluminum Extrusions: ASTM B221, Alloy 6063-T5, T-52, or T6.
- B. Fasteners: Use types and sizes to suit unit installation conditions.
  1. Use screws for exposed fasteners as indicated by the selected Manufacturer.
  2. For fastening aluminum, use aluminum or 300 series stainless steel fasteners.
  3. For color-finished louvers, use fasteners with heads that match color of louvers.
- C. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, fabricated from stainless steel components, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing according to ASTM E488/E488M conducted by a qualified testing agency.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

## 2.7 FABRICATION

- A. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
- B. Join frame members to each other and to fixed louver blades with threaded fasteners, unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

## 2.8 MATERIALS

- A. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.
- B. Fasteners: Use types and sizes to suit unit installation conditions.
  1. Use tamper-resistant screws for exposed fasteners unless otherwise indicated.
  2. For fastening aluminum, use aluminum or 300 series stainless-steel fasteners.
  3. For fastening galvanized steel, use hot-dip-galvanized steel or 300 series stainless-steel fasteners.
  4. For fastening stainless steel, use 300 series stainless-steel fasteners.
  5. For color-finished louvers, use fasteners with heads that match color of louvers.
- C. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, made from stainless-steel components, with capability to sustain, without failure, a load equal to 4 times the loads imposed, for concrete, or 6 times the load imposed for masonry, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

## 2.9 FABRICATION

- A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
- B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
  - 1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern unless horizontal mullions are indicated.
  - 2. Horizontal Mullions: Provide horizontal mullions at joints unless continuous vertical assemblies are indicated.
- C. Maintain equal louver blade spacing, including separation between blades and frames at head and sill, to produce uniform appearance.
- D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
  - 1. Frame Type: Channel flange unless otherwise indicated.
- E. Include supports, anchorages, and accessories required for complete assembly.
- F. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or 72 inches (1830 mm) o.c., whichever is less.
  - 1. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.
- G. Provide subsills made of the same material as louvers or extended sills for recessed louvers.
- H. Join frame members to each other and to fixed louver blades with fillet welds concealed from view, threaded fasteners, or both, as standard with louver manufacturer unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

## 2.1 ALUMINUM FINISHES

- A. Finish louvers after assembly.
- B. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

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

### **3.2 PREPARATION**

- A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

### **3.3 INSTALLATION**

- A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.
- B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.
- C. Form closely fitted joints with exposed connections accurately located and secured.
- D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.
- E. Protect unpainted galvanized and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.
- F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 079200 "Joint Sealants" for sealants applied during louver installation.

### **3.4 ADJUSTING AND CLEANING**

- A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.
- B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.
- C. Restore louvers damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
  - 1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

**END OF SECTION 08 91 19**

## SECTION 09 97 26

### CEMENTITIOUS COATINGS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section includes surface preparation and application of cementitious coating systems on concrete.

##### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: In each color and gloss of topcoat.
  - 1. Submit Samples on rigid backing, not less than 4 inches square.
  - 2. Step coats on Samples to show each coat required for system.
  - 3. Label each coat of each Sample.

##### 1.3 INFORMATIONAL SUBMITTALS

- A. Material certificates. (including Quality Assurance confirmation)
- B. Product test reports.
- C. Cleaning Instructions and Guides. Owner may request in person and/or video demonstration.

##### 1.4 QUALITY ASSURANCE

- A. Mockups: Apply mockups of at least 100 sq. ft. of coating system indicated and each color and finish selected.
- B. Product shall be applied to protect substrate of fuel and oil spillage. Written confirmation from manufacturer shall be provided to owner of this intended use.

#### PART 2 - PRODUCTS

##### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to manufacturers noted in "Cementitious Coating Schedule"

## 2.2 CEMENTITIOUS COATINGS

- A. Polymer-Modified Cementitious Coating: Containing portland cement, polymer, and hydrated lime or aggregates.
  - 1. Compressive Strength: Not less than 3500 psi at 28 days according to ASTM C109/C109M.
  - 2. Tensile Strength: Not less than 350 psi at 28 days according to ASTM C109/C109M.
  - 3. Flexural Strength: adhering to manufacturer requirements.
  - 4. Adhesion: adhering to manufacturer requirements.
  - 5. Permeance: adhering to manufacturer requirements.
  - 6. Accelerated Weathering: adhering to manufacturer requirements.
  - 7. UV Resistance: adhering to manufacturer requirements.
  - 8. Salt-Spray Resistance: adhering to manufacturer requirements.
- B. Performance: Product shall protect substrate from fuel and oil leakage and facilitate easy clean up.
- C. Colors: as selected by owner.
- D. Other Materials: Provide crack fillers, block fillers, and related materials that are compatible with cementitious finish-coat materials and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
  - 1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions for mixing and preparing materials and as applicable to substrates indicated.
- B. Remove plates, machined surfaces, and similar items already in place that are not to be coated. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and coating.
  - 1. After completing coating operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

- C. Clean substrates of substances that could impair bond of coatings, including dirt, oil, grease, incompatible coatings, and loose substrate materials.
- D. Cementitious and Masonry Surfaces: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
- E. Crack Repair: Fill cracks according to manufacturer's written instructions before coating surfaces.

### 3.3 APPLICATION

- A. Apply coatings according to manufacturer's written instructions. Use applicators and techniques suited for coating and substrate indicated.
- B. Apply coating to achieve material thickness as recommended in writing by manufacturer, but not less than the following:
  - 1. First Coat: Apply polymer-modified cementitious coating material at the rate of 2 lb/sq. yd. to achieve a total cured thickness of 25 mils.
  - 2. Second Coat: Apply polymer-modified cementitious coating material at the rate of 1 lb/sq. yd. to achieve a total cured thickness of 15 mils.
- C. On previously coated surfaces, apply coating to achieve material thickness as recommended in writing by manufacturer, but not less than the following:
  - 1. Apply polymer-modified cementitious coating material at the rate of 1 lb/sq. yd. to achieve a total cured thickness of 15 mils.

### 3.4 CEMENTITIOUS COATING SCHEDULE

- A. Above-Grade Concrete and Masonry:
  - 1. Polymer-Modified Cementitious Coating:
    - a. Prime Coat: As recommended in writing by topcoat manufacturer.
    - b. Intermediate Coat: As recommended in writing by topcoat manufacturer.
    - c. Topcoat: Polymer-modified cementitious coating.
      - 1) Stonhard.
      - 2) Sherwin Williams.

**END OF SECTION 09 97 26**

## **SECTION 22 0500**

### **COMMON WORK RESULTS FOR PLUMBING**

#### **GENERAL**

##### **1.1 RELATED REQUIREMENTS**

- A. All conditions imposed by these documents shall be applicable to all portions of the Work under this Division. These references are intended to point out specific items to the Contractor, but in no way relieve him of the responsibility of reading and complying with all relevant parts of the entire Specification.
- B. The Contractor shall examine and coordinate with all Contract Drawings and Specifications, and all Addenda issued. Failure to comply shall not relieve them of responsibility. The omission of details of other portions of the Work from this Division shall not be used as a basis for a request for additional compensation.
- C. The specific features and details for other portions of the Work related to the construction in progress or to the existing building(s) shall be determined by examination at the site.

##### **1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Scope of work.
  - 2. Piping materials and installation instructions common to most piping systems.
  - 3. Transition fittings.
  - 4. Dielectric fittings.
  - 5. Sleeves.
  - 6. Escutcheons.
  - 7. Grout.
  - 8. Plumbing demolition.
  - 9. Equipment installation requirements common to equipment sections.
  - 10. Supports and anchorages.

##### **1.3 DEFINITIONS**

- A. Products and Materials: Components and assemblies for the construction of the systems as indicated in the Documents including, but not limited to pipes, tubes, valves, and equipment.
- B. Products or Materials: See "Products and Materials".

- C. Provide: The materials and equipment described shall be furnished, installed and connected under this Division, complete for operation, unless specifically noted to the contrary. Identical to the phrase "furnish and install".
- D. Furnish: The material, equipment, etc. to be supplied, but not installed by the supplier.

#### 1.4 SCOPE OF WORK

- A. Inspection Of Site
  - 1. The Contractor shall visit the site, inspect the installations and ascertain the conditions to be met and the work.
  - 2. Failure to comply with an inspection of the site shall not constitute ground for any additional payments in connection with removing or modifying any part of the existing installations and/or installing any new work under this Division.
  - 3. Review construction details of the existing portion of the building during the site inspection and include all work required to modify the existing plumbing installations and install new materials, comprising a part of the plumbing installation, within the present structure.
  - 4. Review all construction details of the new portion of the building as illustrated on the architectural and structural drawings and be guided thereby.
- B. Products and Materials Description
  - 1. Where two or more units of the same kind or class of a specific item are required, these shall be the products of a single manufacturer; however, the component parts of the item need not be the products of one manufacturer.
  - 2. In describing the various products and materials, in general each item will be described singularly, even though there may be a multiplicity of identical items. Also, where the description is only general in nature, exact sizes, duties, space arrangements, horsepower requirements and other data shall be determined by reference to the Documents.
- C. The Work shall include modifications and extensions to existing systems, and the modification of the existing structure as required accommodating the installation of the Work.
- D. Refer to other Divisions of the Specifications for related Work.
- E. It is the intent, unless otherwise indicated, that all products and materials described and specified under this Division, shall be provided for a complete working system irrespective of use of the phrases "install", "furnish", "furnish and install", or "provide" as described above has been actually included.
- F. The Contractor shall be responsible for all Work of every description in connection with this Division of the Specifications.
- G. The Contractor shall specifically and distinctly assume, and does so assume, all risk for damage or injury from whatever cause to property or person used or employed on or in connection with this Work and of all damages or injury to any person or property wherever located, resulting from an action or operation under the Contract in connection

with the Work, and undertake the promise to defend the Owner against all claims on account of any such damage or injury.

- H. The Contractor will be held responsible for the satisfactory execution and completion of the Work in accordance with the true intent of the Documents.
- I. The Contractor shall provide without extra charge all incidental items required as part of the Work, even though it may not be specifically indicated. If the Contractor has reason for objecting to the use of any material, equipment, device or method of construction as indicated, he shall make report of such objections to the Owner's Representative, obtain proper approval and adjustment to the Contract, and shall proceed with the Work.
- J. Electric wiring
  - 1. All electric wiring shall be installed under Division 26, except for such equipment items as are prewired at their point of manufacture and so delivered to the project, and except for the following:
    - a. Temperature Control Wiring and Power Wiring provided by controls contractor.
  - 2. Prepare and submit for review wiring diagrams for all equipment furnished under this Division. Show on these diagrams all power, interlock, and control circuits. When the Architect takes no exception to these drawings, they shall become installation drawings for the Contractor.
  - 3. All domestic cold and hot water piping shall be heat traced when routed external to the building or in areas susceptible to freezing conditions.

#### 1.5 ORDINANCES, PERMITS AND CODES

- A. It shall be the Contractor's duty to perform the work and provide the materials covered by these specifications in conformance with all ordinances and regulations of all authorities having jurisdiction.
- B. All work herein shall conform to all applicable laws, ordinances, and regulations of the local utility companies.
- C. The work shall be in accordance with, but not limited to, the requirements of:
  - 1. National Fire Protection Association
  - 2. National Safety Code
  - 3. State and Local Building Codes
  - 4. District of Columbia Safety Code
- D. Codes and standards referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings, and specifications govern.
- E. The Contractor shall obtain permits, plan checks, connection and specification fees, inspections, and approvals applicable to the Work as required by the regulatory authorities.
- F. Fees and costs of any nature whatsoever incidental to permits, inspections, and approvals shall be assumed and paid by the Contractor.
- G. The pro-rata costs, if any, for utilities serving this property will be paid for by the Owner and shall not be included as part of this Contract.

## 1.6 DRAWINGS AND SPECIFICATIONS

- A. The inter-relation of the specifications, the drawings, and the schedules are as follows:
  - 1. The specifications provide the written requirements for the quality, standard, nature of the materials, equipment and construction systems.
  - 2. The drawings establish the quantities, approximate dimensions, details and location of equipment.
  - 3. The schedules give the capacities, characteristics and components.
- B. For any individual project, if there is conflict between the drawings and or specifications, they are equivalent in authority and priority. Should they disagree in themselves, or with each other, prices shall be based on the most expensive combination of quality and quantity of work indicated. In the event of the above mentioned disagreements the resolution shall be determined by the Architect.
- C. Contractor is responsible to bring any conflicts in drawings and/or specifications to the attention of the Architect, immediately, prior to any work being done.
- D. Where the specifications do not fully agree with the schedules, the schedules shall govern. Figures given on drawings govern scale measurements and large scale details govern small scale drawings.
- E. Review all construction details illustrated on the architectural and structural drawings and be guided thereby.

## 1.7 SUBSTITUTIONS

- A. Where the product of a single manufacturer is mentioned by trade name or manufacturer's name in this Division, it is the only acceptable manufacturer.
- B. Where two or more manufacturers are named, only those manufacturers will be considered or approved.
- C. Manufacturers not listed will be considered for substitution prior to bid only. The substitute manufacturer shall submit a complete copy of the appropriate technical specification section minimum ten (10) business days prior to bid with each subparagraph noted with the comment, "compliance", "deviation", "alternate" or "not applicable". In the case of non-primary, vendor-supplied items, the name of the sub-vendor supplying said item, including model number, shall be indicated.
  - 1. By noting the term "compliance" or "C", it shall be understood that the manufacturer is in full compliance with the item specified and will provide exactly the same with no deviations.
  - 2. By noting the term "deviation" or "D", it shall be understood that the manufacturer prefers to provide a different component in lieu of that specified. Manufacturer shall indicate all deviations.
  - 3. By noting the term "alternate" or "A", it shall be understood that the manufacturer proposes to provide the same operating function but prefers to do it in a different manner. An alternate shall be fully described as to what the manufacturer proposes to provide.
  - 4. By noting the term "not applicable" or "N/A", it shall be understood that the specified item is not applicable to the project.

- D. It shall be understood that space allocations have been made on the basis of present and known future requirements and the dimensions of items of equipment or devices of a particular manufacturer whether indicated or not.
- E. Any product or material offered in substitution which differs in dimension or configuration from the Documents, the Contractor shall provide as part of the submittal a drawing, minimum 1/4" = 1'-0" scale, showing that the substitution can be installed in the space available without interfering with other portions of the work or with access for operations and maintenance in the completed project.
- F. Where substitute products or materials requiring different arrangement or connections from that indicated is accepted by the Owner's Representative, install the equipment or devices to operate properly and in harmony with the intent of the Documents, making all incidental changes in piping or wiring resulting from the substitution without any additional cost to the Owner.
- G. The Contractor shall pay all additional costs incurred by other portions of the work in connection with all substitutions.
- H. The Owner's Representative reserves the right to call for samples of any item of product or material offered in substitution, together with a sample of the specific item when, in their opinion, the quality of the item and/or the appearance is involved, and it is deemed that an evaluation of the item may be better made by visual inspection.
- I. When any request for a substitution of a product or material is submitted and rejected, the item named in the Documents shall be furnished. Repetitive submittal of substitutions for the same item will not be considered.

## 1.8 QUALITY ASSURANCE

- A. All Work shall be performed by properly licensed technicians skilled in their respective trades. All materials, equipment and devices shall be installed in accordance with the recommendations of the manufacturer and in the best standard practice to bring about results of a first class condition.
- B. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- C. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- D. Electrical Characteristics for Plumbing Equipment:
  - 1. Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
  - 2. Where variable frequency drives are provided for equipment, whether installed separately or integral to the equipment, the VFDs shall conform to Division 26/16 section, "Variable Frequency Motor Controllers".

- E. Wherever a UL standard has been established for a particular type of material, equipment or device, each item of such material, equipment or device provided on this project shall meet the requirements of the UL standard in every way, and shall be UL listed and labeled.
- F. Products and materials shall be of the best quality customarily applied in quality commercial practice, and shall be by reputable manufacturers.
- G. Each major component shall bear a nameplate giving the name and address of the manufacturer, and the catalog number or designation of the component.
- H. Products and materials provided under this Division of the Specifications shall be essentially the standard item, unless otherwise noted, of the specified manufacturer, or where allowed, an alternate manufacturer.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products and materials with factory-applied end caps or “heat shrink” wrappings to protect openings. Maintain opening protection through shipping, storage, and handling to prevent damage and the entrance of dirt, debris, and moisture.
- B. Store light sensitive products and materials away from and protected against direct sunlight.
- C. Support products and materials at all times to prevent sagging and bending.
- D. The area provided for product and material storage at the jobsite shall be clean, dry and exposure to dust minimized.
- E. Responsibility for the protection of products and materials shall extend to existing equipment, systems, and products and materials. Erect temporary sheltering structures, provide temporary bracing and supports, or cover existing equipment, systems, and products and materials to prevent damage and the entrance of dirt, debris, and moisture.
- F. Failure on the part of the Contractor to comply with the above to the satisfaction of the Architect, Engineer, or either’s authorized representative shall be sufficient cause for the rejection of products and materials in question.

#### 1.10 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces.
- D. Installation Drawings
  - 1. Prepare special drawings as called for elsewhere herein or directed by the Architect to coordinate this work with the work of other Divisions, to illustrate changes in this

work to facilitate its concealment in finished spaces, to avoid obstructions, or to illustrate the installation of a substitute equipment item.

2. Use these drawings in the field for the installation of the work. Unless otherwise directed, do not submit these drawings for review, but provide 3 copies to the Architect for information.

E. Schedule And Sequence Of Work

1. The Contractor shall meet and cooperate with the Owner and Owner's Representative to schedule and sequence Work so as to ensure meeting scheduled completion dates and avoid delaying other portions of the Work. Work requiring special sequencing shall be at no additional cost to the Owner and shall have no impact on the schedule.
2. Work schedules and completion dates as established shall be rigidly adhered to. Cooperate in establishing these schedules and perform the work under this Division at such times as directed so as to ensure meeting scheduled dates and avoid delaying any other Contractor.
3. The facility will continue to be in use throughout the construction period, and the schedule contemplates working in designated areas in the present facility while other adjacent areas are occupied. Execute work in this Division to minimize disturbance to occupants in adjacent areas.
4. When any work affects any services to any occupied area new permanent or temporary services, or a combination of both, shall be installed to enable occupied areas to function properly. Additional valves required shall be installed without added cost to the Owner.
5. Perform no work in the present facility that interferes with normal hours of occupancy, unless special permission is granted by the Owner. Included are operations which would cause objectionable noise or service interruptions. Each discipline shall coordinate their work with the established phases of construction.
6. Any work involving a service suspension shall be scheduled in advance with the Owner.
7. Should it be necessary to perform certain operations on an "overtime" basis in order not to interrupt the normal usage of the facility, include the costs of such overtime without change in the Contract amount.
8. The Contractor shall be responsible for coordinating the demolition and tie-in of the central plant system with the Owner and construction manager.

## PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
  2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

### 2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.

- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.
- C. All piping and tubing shall be American manufactured, unless otherwise indicated.

### 2.3 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
  - 2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- G. Solvent Cements for Joining Plastic Piping:
  - 1. CPVC Piping: ASTM F 493.
  - 2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
- H. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

### 2.4 TRANSITION FITTINGS

- A. Plastic-to-Metal Transition Fittings: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
- B. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
- C. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC and PVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

## 2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
  - 1. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig (1035- or 2070-kPa) minimum working pressure where required to suit system pressures.
- F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
- G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

## 2.6 SLEEVES

- A. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 10, galvanized, plain ends.

## 2.7 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Cast-Brass Type: With set screw.
  - 1. Finish: Polished chrome-plated and rough brass, pending approval by Architect.
- C. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
  - 1. Finish: Polished chrome-plated and rough brass, pending approval by Architect.
- D. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- E. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

## 2.8 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
  - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
  - 3. Packaging: Premixed and factory packaged.

## EXECUTION

### 3.1 PLUMBING DEMOLITION

- A. Disconnect, demolish, and remove plumbing systems, equipment, and components indicated to be removed.
  - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
  - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
  - 3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
  - 4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
  - 5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- B. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

### 3.2 SALVAGED MATERIALS

- A. Reuse no salvaged material except as noted on the Drawings, specified herein, or directed by the Architect. Remove from the premises all present materials falling under this Division, which are removed from the existing building. Upon completion, leave no "dead" line or equipment installed in any portion of the area being remodeled.

### 3.3 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons, after Architect's final approval of finish, for penetrations of walls, ceilings, and floors according to the following:
  - 1. New piping penetrations shall be one-piece escutcheons.
  - 2. Existing piping penetrations shall be two-piece escutcheons.
  - 3. All sleeved penetrations shall be deep-drawn to allow flush installation between escutcheon and finished surface.
- M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level to prevent water entrance to the sleeved hole. Vertical pipe supports must be extended to and supported by the floor and not the sleeve.
    - b. Strike above subparagraph and retain subparagraph below when a pipe curb is required at all floor penetrations in lieu of extended sleeves.
    - c. Provide concrete pipe curb in floors of mechanical equipment areas or other wet areas 4 inches (100 mm) above finished floor level.
  - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
  - 3. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
    - a. Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
    - b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
    - c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of

cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 07 Section "Sheet Metal Flashing and Trim" for flashing.

- 1) Seal space outside of sleeve fittings with grout.
4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- N. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Penetration Firestopping" for materials.
- O. Verify final equipment locations for roughing-in.
- P. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### 3.4 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
  3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
  4. PVC Nonpressure Piping: Join according to ASTM D 2855.
- J. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

### 3.5 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.
  2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.

### 3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- B. Field Welding: Comply with AWS D1.1.

### 3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

- A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor plumbing materials and equipment.
- B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.
- C. Attach to substrates as required to support applied loads.

### 3.8 GROUTING

- A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.

- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

### 3.9 INSTALLATION, INSPECTIONS AND CERTIFICATIONS

- A. The Contractor shall obtain timely inspections of the installation by the constituted authorities. Remedy any deficiencies to the satisfaction of the inspecting authority.
- B. Upon final completion of the work, obtain certificates of acceptance from the constituted authorities. Deliver the certificates to the Architect for transmission to the Owner.

### 3.10 OPERATION PRIOR TO COMPLETION

- A. When any piece of mechanical or electrical equipment is operable and it is to the advantage of the contractor to operate the equipment, he may do so with permission of Owner, providing that he properly supervises the operation, retains full responsibility for the equipment operated, and protects against dirt accumulations during operation. The warranty period shall, however, not commence until such time as the equipment is operated for the beneficial use of the Owner or until final acceptance by the Owner.
- B. Regardless of whether or not the equipment has or has not been operated, the Contractor shall properly clean the equipment, install clean filter media, and properly adjust the operation of the equipment before final acceptance by the Owner.

### 3.11 INSTRUCTION OF OWNER'S PERSONNEL

- A. Provide the services of competent engineers and/or technicians acceptable to the Owner's Representative to instruct other representatives of the Owner in the complete and detailed operation of each item of equipment or device of all the various electrical systems. These instructions shall be provided for whatever periods may be necessary to accomplish the desired results.
- B. Upon completion of these instructions, the Contractor shall obtain a letter of release, acknowledged by the Owner or his authorized representative, stating the dates on which the various kinds of instruction were given, and the personnel to whom the instructions were given.
- C. The Contractor shall be fully responsible for proper maintenance of equipment and systems until the instructions have been given the Owner's personnel and the letter of release acknowledged.
- D. In providing the instructions to the Owner's personnel, the written operating and maintenance manuals shall be followed in all instances, and the Owner's personnel shall be familiarized with such manuals.
- E. Operating and maintenance manuals used for instructions shall include wiring diagrams, manufacturer's operating and maintenance instructions, parts lists (with sources identified), and other data as appropriate for each system.

### 3.12 SEALANT

- A. Apply sealant to penetrations of all floor and wall assemblies to maintain pressure differentials required by AIA, DSHS, CDC, CMC for all pressure sensitive rooms including: Isolation rooms, Protective Environment rooms, Operating rooms, C-section rooms, and Pharmacy including Chemo Prep, Sterile Prep and Ante rooms. Sealant materials and installation requirements are specified in Division 07 Section "Joint Sealants" and Division 09 Section "Gypsum Board Assemblies."

**END OF SECTION 22 0500**

## SECTION 22 0523

### GENERAL-DUTY VALVES FOR PLUMBING PIPING

#### GENERAL

##### 1.1 SUMMARY

- A. Provide piping, valves, fittings and related products as listed on Drawings and described herein.
- B. This Section includes the following general-duty valves:
  - 1. Copper-alloy ball valves.
- C. Related Sections include the following:
  - 1. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and charts.

##### 1.2 DEFINITIONS

- A. The following are standard abbreviations for valves:
  - 1. CWP: Cold working pressure.
  - 2. EPDM: Ethylene-propylene-diene terpolymer rubber.
  - 3. NBR: Acrylonitrile-butadiene rubber.
  - 4. PTFE: Polytetrafluoroethylene plastic.
  - 5. TFE: Tetrafluoroethylene plastic.
  - 6. NRS: Nonrising stem.
  - 7. OS&Y: Outside screw and yoke.

##### 1.3 SUBMITTALS

- A. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; furnished specialties; and accessories.

##### 1.4 QUALITY ASSURANCE

- A. NSF Compliance: NSF 61-G for valve materials for potable-water service.
- B. Bronze valves shall be made with dezincification-resistant materials. All valves shall comply with the current edition of recognized industry standards for design, materials and testing. These standards include but are not limited to MSS SP-80 and MSS SP-110.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, grooves, and weld ends.
  - 3. Set ball and plug valves open to minimize exposure of functional surfaces.
  - 4. Set butterfly valves closed or slightly open.
  - 5. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

## PRODUCTS

### 2.1 VALVES, GENERAL

- A. Refer to Part 3 "Valve Applications" Article for applications of valves.
- B. Bronze Valves: NPS 2 (DN 50) and smaller with threaded ends, unless otherwise indicated.
- C. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- D. Valve Sizes: Same as upstream pipe, unless otherwise indicated.
- E. Valve Actuators:
  - 1. Lever Handle: For quarter-turn valves NPS 6 (DN 150) and smaller, except plug valves.
  - 2. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug head.
- F. Extended Valve Stems: On insulated valves. Valves shall have 2-inch (50-mm) stem extensions and the following features:
  - 1. Ball Valves: Shall have extended operating handle of non-thermal-conductive material, protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation, and memory stops that are fully adjustable after insulation is applied.
    - 1) NIBCO Nib-seal handle extension
    - 2) Conbraco Industries, Inc.; Apollo Div.
    - 3) Jamesbury, Inc.
    - 4) Kitz Insulated Stem Extension Model #ISE 1 thru 4

- 5) Milwaukee Valve: The Insulator/MS
- 2. Butterfly Valves: Shall have extended necks.
- G. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.
- H. Solder Joint: With sockets according to ASME B16.18.
  - 1. Caution: Use solder with melting point below 840 deg F (454 deg C) for check valves; below 421 deg F (216 deg C) for ball valves.
- I. Threaded: With threads according to ASME B1.20.1.
- J. Valve Bypass and Drain Connections: MSS SP-45.

## 2.2 COPPER-ALLOY BALL VALVES

- A. Brass Ball Valves, General: MSS SP-110 and have a brass body complying with ASTM B 283.
- B. Bronze Ball Valves, General: MSS SP-110 and have a copper alloy body complying with ASTM B 584, except for Class 250 which shall comply with ASTM B 61, full-depth ASME B1.20.1 threaded or solder or press connection ends, and blowout-proof stems.
- C. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: Chrome-plated bronze ball and bronze stem and; reinforced TFE seats; threaded body packnut design (no threaded stem designs allowed) with adjustable stem packing, threaded ends; and 150 psig (1034 kPa) SWP 600-psig (4140-kPa)CWP rating.
  - 1. NIBCO Model S-585-80-LF or T-585-80-LF
  - 2. Conbraco Industries, Inc.; Apollo Div.
  - 3. Crane Co.
  - 4. Watts Model
  - 5. Kitz Model 868 or 869
  - 6. Milwaukee UPBA450 or UPBA400
  - 7. Hammond UP8311A or UP88301A
- D. Two-Piece, Full-Port, Copper-alloy Ball Valves with Stainless-Steel Trim: Type 316 stainless-steel vented ball and stem, reinforced TFE seats, threaded body packnut design (no threaded stem designs allowed) with adjustable stem packing, threaded ends; 150 psig (1034 kPa) SWP and 600-psig (4140-kPa) CWP ratings.
  - 1. NIBCO Model S-585-66-LF or T-585-66-LF
  - 2. Conbraco Industries, Inc.; Apollo Div.
  - 3. Crane Co. Model
  - 4. Watts Model
  - 5. Kitz Model 868M or 896M
  - 6. Milwaukee UPBA400S, UPBA450S
  - 7. Hammond UP8303A, UP8313A

## EXECUTION

### 3.1 EXAMINATION

- A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.
- B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- C. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- D. Examine threads on valve and mating pipe for form and cleanliness.
- E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- F. Do not attempt to repair defective valves; replace with new valves.

### 3.2 VALVE APPLICATIONS

- A. Refer to piping Sections for specific valve applications. If valve applications are not indicated, use the following:
  - 1. Shutoff Service: Ball or butterfly valves.
- B. If valves with specified CWP ratings are not available, the same types of valves with higher CWP ratings may be substituted.
- C. Domestic Water Piping: Use the following types of valves:
  - 1. Ball Valves, NPS 2 (DN 50) and Smaller: Two -piece, full port, stainless-steel trim, bronze.
  - 2. Butterfly Valves, NPS 2 to NPS 12 (DN 50 to DN 300): Single-flange, full lug, 200-psig (1380-kPa) CWP rating, bronze disc, EPDM liner, ductile iron.
- D. Select valves, except wafer and flangeless types, with the following end connections:
  - 1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Solder-joint or threaded or press connection ends.
  - 2. For Copper Tubing, NPS 2-1/2 (DN 65) and larger: Flanged ends.

### 3.3 VALVE INSTALLATION

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- C. Locate valves for easy access and provide separate support where necessary.
- D. Install valves in horizontal piping with stem at or above center of pipe.
- E. Install valves in position to allow full stem movement.

### 3.4 JOINT CONSTRUCTION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for basic piping joint construction.
- B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

### 3.5 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

**END OF SECTION 22 0523**

## SECTION 22 05 29

### HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

#### GENERAL

##### 1.1 SUMMARY

- A. This Section includes the following hangers and supports for plumbing system piping and equipment:
  - 1. Metal pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Metal framing systems.
  - 4. Fastener systems.
  - 5. Pipe positioning systems.

##### 1.2 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

##### 1.3 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
- B. Pipe hangers and supports shall conform to the recommendations of ASHRAE, ASPE, ANSI, and MSS, unless otherwise indicated.

##### 1.4 SUBMITTALS

- A. Product Data: For the following:
  - 1. Metal pipe hangers and supports.
  - 2. Thermal-hanger shield inserts.
  - 3. Pipe positioning systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze pipe hangers. Include Product Data for components.
2. Metal framing systems. Include Product Data for components.

## 1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel.", AWS D1.4, "Structural Welding Code--Reinforcing Steel.", ASME Boiler and Pressure Vessel Code: Section IX.
- B. Welding: Qualify procedures and personnel according to the following:
  1. AWS D1.1, "Structural Welding Code--Steel."
  2. AWS D1.2, "Structural Welding Code--Aluminum."
  3. AWS D1.4, "Structural Welding Code--Reinforcing Steel."
  4. ASME Boiler and Pressure Vessel Code: Section IX.

## PRODUCTS

### 2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Available Manufacturers:
  1. AAA Technology & Specialties Co., Inc.
  2. Bergen-Power Pipe Supports.
  3. B-Line Systems, Inc.; a division of Cooper Industries.
  4. Carpenter & Paterson, Inc.
  5. Empire Industries, Inc.
  6. ERICO/Michigan Hanger Co.
  7. Globe Pipe Hanger Products, Inc.
  8. Grinnell Corp.
  9. GS Metals Corp.
  10. National Pipe Hanger Corporation.
  11. PHD Manufacturing, Inc.
  12. PHS Industries, Inc.
  13. Piping Technology & Products, Inc.
  14. Tolco Inc.
  15. Anvil International
- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

## 2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

## 2.3 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Available Manufacturers:
  - 1. B-Line Systems, Inc.; a division of Cooper Industries.
  - 2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
  - 3. GS Metals Corp.
  - 4. Power-Strut Div.; Tyco International, Ltd.
  - 5. Thomas & Betts Corporation.
  - 6. Tolco Inc.
  - 7. Unistrut Corp.; Tyco International, Ltd.
  - 8. Anvil International
- C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

## 2.4 FASTENER SYSTEMS

- A. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated or stainless steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
  - 1. Available Manufacturers:
    - a. B-Line Systems, Inc.; a division of Cooper Industries.
    - b. Empire Industries, Inc.
    - c. Hilti, Inc.
    - d. ITW Ramset/Red Head.
    - e. MKT Fastening, LLC.
    - f. Powers Fasteners.

## 2.5 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.
- B. Manufacturers:
  - 1. C & S Mfg. Corp.
  - 2. HOLDRITE Corp.; Hubbard Enterprises.
  - 3. Samco Stamping, Inc.

## 2.6 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

## EXECUTION

### 3.1 PREPARATION

- A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including, but not limited to proper placement of inserts, anchors and other building structural attachments.

### 3.2 HANGER AND SUPPORT APPLICATIONS

- A. Use only one type hangers and supports, by one manufacturer, for each piping service.
- B. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- C. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- D. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- E. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- F. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing or provide copper-plated hangers and supports for copper piping systems where hangers are in contact with bare pipe.
- G. Use padded hangers for piping that is subject to scratching.
- H. Horizontal-Piping Hangers and Supports, select size of hangers and supports to exactly fit pipe size for bare piping, and around piping insulation with saddle or shield for insulated piping. Unless otherwise indicated and except as specified in piping system Sections, install the following types. Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).

2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F (49 to 232 deg C) pipes, NPS 4 to NPS 16 (DN 100 to DN 400), requiring up to 4 inches (100 mm) of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24 (DN 20 to DN 600), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24 (DN 15 to DN 600), if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8 (DN 20 to DN 200).
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN 200).
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 (DN 15 to DN 50).
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8 (DN 10 to DN 200).
11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3 (DN 10 to DN 80).
12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30 (DN 15 to DN 750).
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
16. Adjustable, Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36 (DN 65 to DN 900), if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30 (DN 25 to DN 750), from 2 rods if longitudinal movement caused by expansion and contraction might occur.

18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20 (DN 65 to DN 500), from single rod if horizontal movement caused by expansion and contraction might occur.
  19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42 (DN 50 to DN 1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
  20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24 (DN 50 to DN 600), if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
  21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30 (DN 50 to DN 750), if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- I. Vertical-Piping Clamps: Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500).
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN 20 to DN 500), if longer ends are required for riser clamps.
- J. Hanger-Rod Attachments: Select size of hanger rod attachments to suit hanger rods. Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
  3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.
- K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.

2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
  10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
  11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  12. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb (340 kg).
    - b. Medium (MSS Type 32): 1500 lb (680 kg).
    - c. Heavy (MSS Type 33): 3000 lb (1360 kg).
  13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
  15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.

3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- M. Spring Hangers and Supports: Select spring hangers and supports to suit pipe size and loading. Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
  2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
  3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
  4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
  5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
  6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
  7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
  8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
    - a. Horizontal (MSS Type 54): Mounted horizontally.
    - b. Vertical (MSS Type 55): Mounted vertically.
    - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- N. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- O. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- P. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

### 3.3 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required by the following table to properly support piping from building structure.

Pipe Size (in)	Max. Hanger Spacing (ft)	Min. Rod Size (in)	Max. Alternate Hanger Spacing (ft)	Min. Alternate Rod Size (in)
1/2	6	3/8	--	--
3/4	6	3/8	--	--
1	7	3/8	--	--
1-1/4	8	3/8	--	--
1-1/2	9	3/8	--	--
2	10	3/8	--	--
2-1/2	11	1/2	--	--
3	12	1/2	8	3/8

- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
  2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
1. Verify suitability of fasteners in two subparagraphs below for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick.
  2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Section "Plumbing Fixtures" for plumbing fixtures.
- G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

- H. Install hangers and supports to allow controlled thermal of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.
- M. Insulated Piping: Comply with the following:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
  - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
  - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
  - 4. Shield Dimensions for Pipe: Not less than the following:

Pipe Size (in)	Shield Length (in)	Minimum Gauge
1/2 to 1-1/2	4	26
2 to 6	6	20
8 to 10	9	16
12 to 18	12	16
20 and larger	18	16

5. Pipes NPS 8 (DN 200) and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

### 3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1 inch (25 mm).

### 3.6 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).

- B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

**END OF SECTION 22 0529**

## **SECTION 22 05 53**

### **IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT**

#### **GENERAL**

##### **1.1 SUMMARY**

- A. Section Includes:
  - 1. Equipment labels.
  - 2. Pipe labels.
  - 3. Valve tags.

##### **1.2 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

##### **1.3 COORDINATION**

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

## PRODUCTS

### 2.1 EQUIPMENT LABELS

#### A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, laminated phenolic with a black surface and white substrate for mechanical engraving, 1/16 inch (1.6 mm) Minimum thick, and having predrilled holes for attachment hardware and beveled edges.
2. Letter Color: White
3. Background Color: Black
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1/2 inch (13 mm). Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, as directed by the owner. Secondary lettering shall indicate date of installation.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

D. Punched plastic tape for labels is not acceptable.

### 2.2 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction. Labels shall conform to ANSI A13.1 and the following table:

<b>Outside Diameter of Pipe of Covering</b>	<b>Height of Letters</b>
3/4" to 1-1/4"	1/2"
1-1/2" to 2"	3/4"
2-1/2" to 6"	1-1/4"

B. Available Manufacturers: Seton, Brady, or Westline.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover or cover full circumference of pipe.

D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

- E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.

### 2.3 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.
  - 1. Tag Material: Brass, 0.032-inch (0.8-mm) minimum thickness and having predrilled or stamped holes for attachment hardware.
  - 2. Fasteners: Brass wire-link and S-hook or beaded chain
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
  - 1. Valve-tag schedule shall be included in operation and maintenance data.

## EXECUTION

### 3.1 PREPARATION

- A. Clean piping and equipment surface of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

### 3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

### 3.3 PIPE LABEL INSTALLATION

- A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.

4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
7. In no case shall an exposed line enter or leave a room without being identified.
8. Secure identification markers to piping by firmly pressing markers in place, following removal of protective covering. Additionally secure by banding ends of markers in place using 1/2 inch wide aluminum bands of the type normally used to secure insulation in place.

B. Pipe Label Color Schedule: CORDINATE WITH OWNER

1. Domestic Water Piping:

- a. Background Color: Green.
- b. Letter Color: White.

3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

**END OF SECTION 22 0553**

## **SECTION 22 0700**

### **PLUMBING INSULATION**

#### **PART 1 – GENERAL**

##### **1.1 WORK INCLUDED**

A. The work of this Section shall include, but is not limited to, the following:

1. Piping insulation, jackets

##### **1.2 REFERENCE STANDARDS**

Published specifications standards, tests or recommended methods of trade, industry or governmental organizations apply to work in this Section where cited below:

- A. ASTM – American Society for Testing and Materials
- B. NFPA – National Fire Protection Association
- C. UL – Underwriters Laboratories Inc.
- D. International Plumbing Code
- E. International Building Code

##### **1.3 QUALITY ASSURANCE**

- A. All insulation shall be in accordance with ASHRAE Standard 90, the IECC and all applicable codes.
- B. Insulation supplier and insulation installer shall have a minimum of 5 years' successful installation experience on projects of similar scope to this project.

##### **1.4 SUBMITTALS**

- A. Product Data: Provide product description, current Product Data Sheets, list of materials and thickness for each service or equipment scheduled, locations, and manufacturer's installation instructions.
- B. Submit details of sheet metal boxes for pieces of insulated equipment. Refer to sub-Clause 2.05, A.6.
- C. Quality Assurance / Control Submittals:
  1. Certificates: Submit manufacturer's certificate that product(s) meet or exceed specified requirements.

## 1.5 ENVIRONMENTAL REQUIREMENTS

- A. Maintain ambient temperatures and conditions during storage and installation of all products required by manufacturers of adhesives, mastics, and insulation cements.
- B. Protect insulation from contact with water.

## PART 2 – PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Fiberglass: Johns Manville; Knauf; Owens Corning.
- B. Calcium Silicate: Johns Manville; Extol of Ohio, Inc.
- C. Elastomeric: Armacell; Aeroflex.
- D. Cellular Glass: Pittsburgh Corning.
- E. Adhesives and Sealers: Ductmate; Benjamin Foster (BF); 3M; Childers.
- F. Jackets:
  - 1. Metal: Childers; RPR Products.
  - 2. PVC: Ceel-Co; PIC Plastics.
  - 3. Other: Venture Tape; Polyguard.
- G. Pre-Molded Fittings, Valves, Strainers and Equipment Insulation: Insul-Therm International; Extol of Ohio, Inc.; or approved equal.

### 2.2 GENERAL

- A. Conform to application schedule for type and thickness of insulation.
- B. Insulation, jacket, facing and adhesives shall be non-combustible material meeting Code requirements and fire and smoke hazard ratings as tested by procedure ASTM E 84, National Fire Protection Association 225, and UL 723, not exceeding Flame Spread 25 and Smoke Developed 50.
- C. Adhesive, mastic or insulating material shall not contain asbestos.
- D. Vapor jacket permeance shall be 0.02 perms or less.
- E. Jacket puncture resistance shall be 50 units (Beach) or greater.

### 2.3 PIPE INSULATION MATERIALS

- A. Glass Fiber: ASTM C 547; rigid molded, non-combustible.
  - 1. Installed 'K' Value: 0.23 BTU-inch per hour-foot<sup>2</sup>-degree F at 75 degrees F.
  - 2. Maximum Service Temperature: 850 degrees F.

3. Vapor Retarder Jacket: White kraft paper, vinyl coated, embossed and reinforced with glass fiber yarn and bonded to aluminum foil, secure with self-sealing longitudinal laps and butt strips.
- B. Hydrous Calcium Silicate: ASTM C 533; rigid molded pipe.
1. Installed 'K' Value: 0.40 BTU-inch per hour-foot<sup>2</sup>-degree F at 300 degrees F.
  2. Maximum Service Temperature: 1200 degrees F.
  3. Tie Wire: 16-gauge stainless steel with twisted ends on maximum 12-inch centers.
- C. Elastomeric Foam: ASTM C 534/C 534M flexible cellular elastomeric, molded or sheet.
1. Installed 'K' Value: 0.27 BTU-inch per hour-foot<sup>2</sup>-degree F at 75 degrees F.
  2. Maximum Service Temperature: 220 degrees F.
- D. Cellular Glass:
1. Inorganic, foamed or cellulated glass, annealed, rigid, hermetically sealed cells, incombustible.
  2. Preformed Pipe Insulation with Jacket: Comply with ASTM C 552, Type II, Class 2.
- E. Field-Applied Jackets:
1. PVC Plastic (PVC): One-piece molded type fitting covers and sheet material, gloss white. Connections shall be pressure-sensitive color-matching vinyl tape.
  2. Canvas Jacket (CJ): UL Listed fabric, 6 ounce per square yard, plain weave cotton treated with dilute fire-retardant lagging adhesive.
  3. Aluminum Jacket (AL): 0.016-inch thick sheet, stippled finish, with longitudinal slip joints and 2-inch laps, die-shaped fitting covers with factory-attached protective liner.
  4. Stainless Steel Jacket (SSJ): Type 304 stainless steel, 0.010 inch, smooth finish.

## 2.4 PIPE INSULATION SCHEDULES

### A. Insulation Schedules:

Service	Temperature Range (degrees F)	Insulation Thickness (inches) for Pipe Sizes:		
		1 and less	1.25 to 2	2.5 to 4
Domestic Cold Water	All	1.5	1.5	1.5

### B. Fittings, Valves and Flanges:

1. Use factory pre-molded fittings of the same materials and thickness as the adjacent pipe insulation. Such fittings shall be applied to all 90°s, 45°s, Tee's, flanges, and valves.
2. Where pre-molded insulation fittings are not manufactured, insulate fittings, flanges, strainers and valves with mitered segments of the same density as the adjoining pipe covering. Vaporseal for cold (below dew point) applications using adhesive with open weave glass mesh lay in while wet. Provide a final coat of adhesive. Overlap glass mesh and outer coat adjacent covering by a minimum of 2 inches. Adhesive shall be IC 501 or BF 30-35.
3. Provide insulation for the removable covers and flanges of pipe strainers on cold services with built-up sections of glass fiber pipe covering, arranged to facilitate servicing of the strainer. Complete applications with vaporseals as specified above. Vapor barriers shall be sealed and continuous through guides, hangers, walls, sleeves, etc. Adhesives and coatings shall be as noted herein.

C. Jacketing Schedule:

Service	Location	Jacket Type
Domestic cold water	All locations	ASJ
Outdoor piping	All locations	AL

### PART 3 – EXECUTION

#### 3.1 EXAMINATION AND PREPARATION

- A. Verify that all surfaces are clean, dry and free of dirt, duct, debris, moisture or foreign material.

#### 3.2 INSTALLATION

- A. Install materials in accordance with manufacturer's recommendations, building codes and industry standards.
- B. Verify piping has been pressure-tested as specified in Section 22 11 10 – Plumbing Piping and Accessories before applying insulation materials to pipe joints.
- C. Continue insulation and vapor barrier through penetrations.
- D. Piping, Valve and Accessories Insulation:
  1. Insulate domestic water supply lines inside chases and up to the plumbing fixture supply stop.
  2. Locate insulation and cover seams in least visible locations where exposed.
  3. Neatly finish insulation at supports, protrusions, and interruptions.
  4. Provide insulated pipes, fittings, valves and accessories conveying fluids below ambient temperature with continuous vapor retarder jackets with

- self-sealing laps. Insulate complete system and provide molded flexible polyvinyl chloride jacket(s) for all fittings and valves. Vaporseal all jacket seams as recommended by the insulation manufacturer.
5. For insulated pipes, fittings, valves and accessories conveying fluids above ambient temperature, secure jackets with self-sealing lap. Bevel and seal ends of insulation at equipment, flanges and unions.
  6. Protect pipe insulation at hangers, guides, and rollers with 20-gauge galvanized metal shields, one-third the insulation circumference in width and minimum 10 inches in length up to 2½-inch pipe size, 12 inches in length on pipes 3-inch and larger, on the outside of the insulation and vapor barrier or jacket. Center shield on hanger and hold shield in place by straps or by manufactured centering tabs or channels on the shield itself. Do not pierce the insulation with hangers.
  7. Provide insert between support shield and piping. Fabricate of calcium silicate, rigid phenolic or other heavy density non-deforming insulating material suitable for temperature. Length of insulation inserts shall match support shield length as specified.
  8. For exterior applications or locations where abrasion or damage may occur, provide weather protection jacket. Insulated pipe, fittings, accessories joints, and valves shall be covered with ultra-violet light-resistant painted polyvinyl chloride or aluminum jacket. Jacket seams shall be located on bottom side of horizontal piping.
  9. Apply prefabricated sectional insulation for straight pipes neatly fitted around the piping, and sealed with adhesive. Apply adhesive to only one side of each joint and not to pipe surface.
  10. Seal all joints with BF 30-35 fire-resistant vapor barrier mastic. Oversized pipe sections or board type insulation may be used to fabricate and install insulation around pipe specialties. All void spaces shall be firmly filled with flexible insulation to support oversized pipe insulation.
  11. Secure sectional insulation with 0.02-inch thick by 1/2-inch wide aluminum bands manufactured by Childers, or RPR Products nylon ties, on 24-inch centers for pipe sizes 2 inches and larger. Install at least two (2) bands per section of insulation.
  12. Insulate domestic cold water vertical riser support clamps.
  13. Insulate and thoroughly vaporseal control valve bodies where the valve actuator penetrates the insulation.
  14. Thoroughly vaporseal the ends of all domestic cold water pipe, valve and fitting insulation sections to prevent condensation from wicking between sections.
  15. Replace any self-sealing insulation or lap that is found to be not sealing properly. Do not use staples to secure the insulation or coverings.

**END OF SECTION 22 0700**

## SECTION 22 0710

### HEAT TRACING FOR PLUMBING

#### PART 1 GENERAL

##### 1.1 WORK INCLUDED

- A. Provide a UL-listed system of electric self-regulating heating cable, control panels and components to prevent pipes from freezing at the locations where indicated on the drawings. The cable shall utilize a radiation-cross linked conductive polymer as the heating element, and the cable shall be specifically designed, manufactured, and UL listed for freeze protection of pipes.

##### 1.2 RELATED DOCUMENTS

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

##### 1.3 SUMMARY

- A. Section includes plumbing piping heat tracing for freeze prevention of domestic water piping with the following electric heating cables:
  - 1. Self-regulating, parallel resistance.

##### 1.4 SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include rated capacities, operating characteristics, and furnished specialties and accessories.
  - 2. Schedule heating capacity, length of cable, spacing, and electrical power requirement for each electric heating cable required.
- B. Shop Drawings: For electric heating cable.
  - 1. Include plans, elevations, sections, and attachment details.
  - 2. Include diagrams for power, signal, and control wiring.
- C. Field quality-control reports.
- D. Sample Warranty: For special warranty.
- E. Operation and Maintenance Data: For electric heating cables to include in operation and maintenance manuals.

## 1.5 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace electric heating cable that fails in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.

## PART 2 PRODUCTS

### 2.1 SELF-REGULATING, PARALLEL-RESISTANCE HEATING CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following: See drawings:
  - 1. Thermon Americas Inc.
- B. Comply with IEEE 515.1.
- C. Heating Element: Pair of parallel No. 16 AWG, nickel-coated, stranded copper bus wires embedded in cross-linked conductive polymer core, which varies heat output in response to temperature along its length. Terminate with waterproof, factory-assembled, nonheating leads with connectors at one end, and seal the opposite end watertight. Cable shall be capable of crossing over itself once without overheating.
- D. Electrical Insulating Jacket: Flame-retardant polyolefin.
- E. Cable Cover: 14 AWG Tinned Copper Metallic braid and polyolefin outer jacket with ultraviolet inhibitor.
- F. Maximum Operating Temperature (Power On): 150 deg F.
- G. Maximum Exposure Temperature (Power Off): 185 deg F.
- H. 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.
- I. Capacities and Characteristics:
  - 1. Maximum Heat Output: 3W/ft., 5Wt/ft, or 8 W/ft as required by the manufacturer's design guide.
  - 2. Piping Diameter: (size as indicated on drawings) NPS.
  - 3. Number of Parallel Cables: As required by the manufacturer's design guide.
  - 4. Electrical Characteristics for Single-Circuit Connection:
    - a. Volts: 277.

## 2.2 CONTROLS

- A. Local Digital Controller and Monitoring Module with Ground Fault Protection and Alarm:
1. The system shall be field-mounted and shall have FM or CSA approval.
  2. The system shall be preprogrammed for freeze protection applications. The controller shall sense ambient temperature in the general area of the traced pipe and turn heat tracing on when outside temperature is below 40°F and turn the heat tracing off when outside temperature is above 42°F.
  3. The system shall provide the user with the option of line-sensing control with a user-selectable dead band, ambient sensing, proportional ambient sensing (PASC), and power limiting control modes.
  4. The system must have a programmable auto cycle heating cable test feature to alert the panel of electrical problems.
  5. The system has an alarm relay to provide annunciation back to a Distributed Control System (DCS).
  6. Electric code-approved ground-fault detection (GFPD) equipment shall be integral to the controller to simplify installation, maintenance, and reduce total cost.
  7. Enclosure type shall be NEMA 4X fiberglass-reinforced plastic (FRP).
  8. The controller will be used in conjunction with remote temperature device RTD-500-3.
  9. The system shall provide real time data for temperature, heater current, and ground leakage current. Monitoring and alarm shall be provided for low temperature, high temperature, low heater current, high heater current, ground leakage current, and damaged RTD sensor(s).
  10. Controller shall support the Modbus™ RTU or ASCII/HTCbus communications protocol and be supplied complete with RS-485 communications interface capability and shall have the available option of a multi-protocol gateway for protocol translation between Building Management Systems (BMS) using, BACnet.

## 2.3 ACCESSORIES

- A. Connection Kits: All heating cable connection kits shall be UL Listed, CSA Certified and FM Approved for use as part of the system to maintain hot water temperature and pipe freeze protection. Component enclosures shall be rated NEMA 4X to prevent water ingress and corrosion. Installation shall not require the installing contractor to cut into the heating cable core to expose the bus wires. Connection systems requiring the installing contractor strip the bus wires, or which use crimps or terminal blocks, shall not be acceptable. All connection kits except for the power connection shall be installed under the thermal insulation. The end seal shall use silicone gel.
- B. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.

- C. Warning Labels: Refer to Section 22 05 53, "Systems Identification for Plumbing".
- D. Warning Tape: Continuously printed "Electrical Tracing"; vinyl, at least 3 mils thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.
  - 1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.
  - 2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Examine surfaces and substrates to receive electric heating cables for compliance with requirements for installation tolerances and other conditions affecting performance.
  - 1. Ensure surfaces and pipes in contact with electric heating cables are free of burrs and sharp protrusions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 APPLICATIONS**

- A. Install the following types of electric heating cable for the applications described:
  - 1. Freeze protection for plumbing piping: Self-regulating, parallel-resistance heating cable.

### **3.3 INSTALLATION**

- A. Install electric heating cable across expansion, construction, and control joints according to manufacturer's written instructions; use cable-protection conduit and slack cable to allow movement without damage to cable.
- B. Electric Heating-Cable Installation for Freeze Protection for Piping:
  - 1. Install electric heating cables after piping has been tested and before insulation is installed.
  - 2. Install electric heating cables according to IEEE 515.1.
  - 3. Install insulation over piping with electric cables according to Section 220700 "Plumbing Piping Insulation."
  - 4. Install warning tape on piping insulation where piping is equipped with electric heating cables.
- C. Set field-adjustable switches and circuit-breaker trip ranges.

### 3.4 CONNECTIONS

- A. Ground equipment per Division 26 specifications.
- B. Connect wiring per Division 26 specifications.

### 3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.
  - 2. Test cables for electrical continuity and insulation integrity before energizing.
  - 3. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.
- D. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounted cables.
- E. Prepare test and inspection reports.

### 3.6 PROTECTION

- A. Protect installed heating cables, including nonheating leads, from damage during construction.
- B. Remove and replace damaged heat-tracing cables.

**END OF SECTION**

## SECTION 22 1116

### DOMESTIC WATER PIPING

#### GENERAL

##### 1.1 SUMMARY

- A. Provide piping, valves, fittings and related products as listed on Drawings and described herein. All products to be purchased from Ferguson Enterprises.
- B. Section Includes:
  - 1. Aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
- C. Related Section:
  - 1. Division 22 Section "Domestic Water Piping Specialties".

##### 1.2 PERFORMANCE REQUIREMENTS

- A. Provide components and installation capable of producing domestic water piping systems with 80 psig (550 kPa), unless otherwise indicated.

##### 1.3 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Water Sample Reports: Specified in Part 3 "Cleaning" Article.
- C. Field quality-control test reports.

##### 1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 61 and NSF 372 for potable domestic water piping and components.

## 1.5 PROJECT CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
1. Notify Architect, Construction Manager and Owner no fewer than two days in advance of proposed interruption of water service.
  2. Do not proceed with interruption of water service without Owner's written permission.

## PRODUCTS

### 2.1 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) water tube, drawn temper.
1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
  2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
  3. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
  4. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

### 2.2 PIPING JOINING MATERIALS

- A. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- C. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

### 2.3 SPECIALTY VALVES

- A. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves, drain valves, backflow preventers, and vacuum breakers.

### 2.4 TRANSITION FITTINGS

- A. General Requirements:

1. Same size as pipes to be joined.
  2. Pressure rating at least equal to pipes to be joined.
  3. End connections compatible with pipes to be joined.
- B. Sleeve-Type Transition Coupling: AWWA C219.
1. Manufacturers:
    - a. Cascade Waterworks Manufacturing.
    - b. Dresser, Inc.; Dresser Piping Specialties.
    - c. Ford Meter Box Company, Inc. (The).
    - d. JCM Industries.
    - e. Romac Industries, Inc.
    - f. Smith-Blair, Inc; a Sensus company.
    - g. Viking Johnson; c/o Mueller Co.

## 2.5 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.
- B. Dielectric Unions:
1. Manufacturers:
    - a. EPCO Sales, Inc.
    - b. Hart Industries International, Inc.
    - c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    - d. Zurn Plumbing Products Group; Wilkins Water Control Products.
  2. Description:
    - a. Pressure Rating: 150 psig (1035 kPa) at 180 deg F (82 deg C).
    - b. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric-Flange Kits:
1. Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Central Plastics Company.
    - d. Pipeline Seal and Insulator, Inc.
  2. Description:
    - a. Nonconducting materials for field assembly of companion flanges.
    - b. Pressure Rating: 150 psig (1035 kPa).

- c. Gasket: Neoprene or phenolic.
- d. Bolt Sleeves: Phenolic or polyethylene.
- e. Washers: Phenolic with steel backing washers.

D. Dielectric Couplings:

- 1. Manufacturers:
  - a. Calpico, Inc.
  - b. Lochinvar Corporation.
- 2. Description:
  - a. Galvanized-steel coupling.
  - b. Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C).
  - c. End Connections: Female threaded.
  - d. Lining: Inert and noncorrosive, thermoplastic.

E. Dielectric Nipples:

- 1. Manufacturers:
  - a. Perfection Corporation; a subsidiary of American Meter Company.
  - b. Precision Plumbing Products, Inc.
  - c. Victaulic Company.
- 2. Description:
  - a. Copper-Silicon nipple complying with ASTM F 1545.
  - b. Pressure Rating: 300 psig (2070 kPa) at 225 deg F (107 deg C)
  - c. End Connections: Male threaded or grooved.

## EXECUTION

### 3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install shutoff valve, hose-end drain valve, strainer and pressure gage inside the building at each domestic water service entrance. Comply with requirements in Division 22 Section "Meters and Gages for Plumbing Piping" for pressure gages and Division 22 Section "Domestic Water Piping Specialties" for drain valves and strainers.
- D. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.

- E. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- F. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- H. Install piping adjacent to equipment and specialties to allow service and maintenance.
- I. Install piping to permit valve servicing.
- J. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.
- K. Install piping free of sags and bends.
- L. Install fittings for changes in direction and branch connections.
- M. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- N. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 22 Section "Common Work Results for Plumbing."
- O. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 22 Section "Common Work Results for Plumbing."

### 3.2 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" Chapter.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems and provide Dielectric isolator.

### 3.3 VALVE INSTALLATION

- A. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball valves for piping NPS 2 (DN 50) and smaller. Use butterfly valves for piping NPS 2-1/2 (DN 65) and larger.

### 3.4 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
  - 1. NPS 2 (DN 50) and Larger: Sleeve-type coupling.

### 3.5 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric couplings, nipples or unions.
- C. Dielectric Fittings for NPS 2-1/2 (DN 65) and Larger: Use dielectric flange kits.

### 3.6 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.

### 3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

### 3.8 IDENTIFICATION

- A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.

### 3.9 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Piping Inspections:
  - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
  - 2. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
    - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
  - 3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
  - 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- C. Piping Tests:
  - 1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
  - 2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
  - 3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - 4. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
  - 5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
  - 6. Prepare reports for tests and for corrective action required.
- D. Domestic water piping will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

### 3.10 ADJUSTING

- A. Perform the following adjustments before operation:
  - 1. Close drain valves, hydrants, and hose bibbs.
  - 2. Open shutoff valves to fully open position.
  - 3. Open throttling valves to proper setting.
  - 4. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
  - 5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
  - 6. Check plumbing specialties and verify proper settings, adjustments, and operation.

### 3.11 CLEANING

- A. Clean and disinfect potable and non-potable domestic water piping as follows:
  - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
  - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
    - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    - b. Fill and isolate system according to either of the following:
      - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (50 mg/L) of chlorine. Isolate with valves and allow to stand for 24 hours.
      - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm (200 mg/L) of chlorine. Isolate and allow to stand for three hours.
    - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    - d. Submit water samples for testing in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

### 3.12 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

- C. Aboveground domestic water piping, NPS 2 (DN 50) and smaller, shall be one of the following:
  - 1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B) ASTM B 88; cast- or wrought- copper solder-joint fittings; and soldered joints.

### 3.13 VALVE SCHEDULE

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
  - 1. Shutoff Duty: Use ball valves for piping NPS 2 (DN 50) and smaller.
  - 2. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

**END OF SECTION 22 1116**

## **SECTION 22 11 19**

### **DOMESTIC WATER PIPING SPECIALTIES**

#### **GENERAL**

##### **1.1 SUMMARY**

- A. Provide plumbing fixtures and drains as listed on Drawings and described herein.
- B. This Section includes the following domestic water piping specialties:
  - 1. Drain valves.
  - 2. Hose bibbs.
- C. Related Sections include the following:
  - 1. Division 22 Section "Domestic Water Piping".

##### **1.2 PERFORMANCE REQUIREMENTS**

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig (860 kPa), unless otherwise indicated.

##### **1.3 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For domestic water piping specialties to include operation, and maintenance manuals.

##### **1.4 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. NSF Compliance:

1. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."
2. NSF Compliance: NSF 61-G for valve materials for potable-water service.

## PRODUCTS

### 2.1 DRAIN VALVES

#### A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
3. Body: Copper alloy.
4. Ball: Chrome-plated brass.
5. Seats and Seals: Replaceable.
6. Handle: Vinyl-covered steel.
7. Inlet: Threaded or solder joint.
8. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

### 2.2 HOSE BIBBS

#### A. Anti-Siphon Wall Faucets: See Plumbing Schedule on P0.001-4.

## EXECUTION

### 3.1 INSTALLATION

- #### A.
- Install water control valves with inlet and outlet shutoff valves and bypass with globe valve. Install pressure gages on inlet and outlet.

### 3.2 CONNECTIONS

- #### A.
- Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.
- #### B.
- Ground equipment according to Division 26 Section.

### 3.3 LABELING AND IDENTIFYING

- #### A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
1. Drain valves.

- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

#### 3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
  - 1. Test each drain valve.
- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

**END OF SECTION 22 1119**

## SECTION 23 05 01

### MECH GENERAL PROVISIONS

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION

- A. The General, Supplementary Conditions and any architectural specifications are a part of the requirements for the work under this Division of the Specification.
- B. Provide labor and materials required to install, test and place into operation the heating, ventilating, air conditioning, as called for in the Contract Documents, and according to Washington, D.C. codes and regulations.
- C. Applicable equipment and materials to be listed by Underwriters' Laboratories and manufactured in accordance with ASME, AWWA, or ANSI standards, and as approved by authorities having jurisdiction. The Energy using products shall be certified for use in District of Columbia and meet State energy efficient standards.
- D. Submit shop drawings, manufacturer's data, samples and test reports (three copies minimum). Contractor shall allow five working days minimum review from the time it is received by the Engineer.
- E. The Contract Documents show the general arrangement of equipment, ductwork, piping and accessories. Follow these drawings as closely as the actual construction and the work of other trades will permit. Provide offsets, fittings, and accessories which may be required but not shown on the Drawings. Investigate the site and review drawings of other trades to determine conditions affecting the work and provide such work and accessories as may be required to accommodate such conditions.
- F. Install firestopping around all pipes, conduits, ducts, etc. which pass through rated walls, partitions and floors in strict accordance with the manufacturer's published approval listing and rating.
- G. Before commencing work, examine adjoining work on which this work is in any way dependent and report conditions which prevent performance of the work. Become thoroughly familiar with actual existing conditions to which connections must be made or which must be changed or altered.
- H. Wherever the word "Provide" is used, it shall mean "Furnish and install complete and ready for use".
- I. Evaluate existing conditions which may affect methods or cost of performing the work, based on examination of the site or other information. Failure to examine the Drawings, this document or other information does not relieve the Contractor of responsibility for satisfactory completion of the work.
- J. Provide two (2) copies of operating instructions and maintenance manuals for all equipment and materials furnished under this Division upon two (2) weeks after completion of project.
- K. Maintain on a daily basis at the project site a complete set of Record Drawings, reflecting an accurate dimensional record of all deviations between work shown on Drawings and that actually installed.

- L. Coordinate, with building management, the requirements for after-hours work needed for tenant tie-ins to base building systems.
- M. Locate all equipment needing service in accessible locations and on one side of the unit when possible. Coordinate with general contractors to provide access panels in inaccessible ceilings. Minor deviations from drawings can be made in order to provide better accessibility.
- N. Select appropriate State and Code
- O. Contractor shall allow for testing and rebalancing of all existing to be reused equipment as well as new.
- P. Coordinate all work with existing structure, piping on conduits.
- Q. Obtain and pay for all required fees, permits and inspections.
- R. Obtain written permission of Owner before cutting or patching of structural systems.
- S. Guarantee work for one (1) year from date of filing Notice of Completion.
- T. Remove all abandoned mechanical equipment and associated ductwork, piping, etc., unless otherwise specified by Owner.
- U. Pressure test each system of piping and ductwork as specified.
- V. Edit list to suit project requirements.
- W. Submittals: Prior to construction submit for approval the following materials and equipment. Submittal should be submitted in a binder and should include equipment cut sheets, dimensions, capacities, wiring diagram and electrical loads, special installation details, etc.
  - 1. Duct specialties
  - 2. Fans
  - 3. Other miscellaneous equipment as specified and or scheduled on drawings.
  - 4. Vibration isolation and seismic restraints.
- X. Provide a complete set of as-builts for the entire project in Autocad 2025 format within one month after the completion of project. Submit one disk containing electronic files as well as one set of prints for review prior to issuance of final as-builts

**END OF SECTION 23 05 01**

**SECTION 23 05 13**

**ELECTRIC MOTORS**

**PART 1 - GENERAL**

1.1 DESCRIPTION

- A. One-half horsepower and larger motors shall be rated 460 Volts Alternating Current (VAC) and suitable for operation on a 480 VAC (±5 %), 3-phase, 60 Hz nominal electricity supply system.
- B. One-third horsepower and smaller motors shall be rated 120 VAC, single-phase, 60 Hz, and shall be provided with integral thermal overload protection.
- C. Motors shall be generally constant speed, squirrel-cage type, open drip-proof or totally enclosed fan cooled (TEFC) design. Single phase motors shall be high efficiency capacitor start, induction run, or split phase type as approved for the service.
- D. Provide motors having minimum certification by NEMA Table 12-6D. Two-speed motors, motors, driven by variable frequency drives and special duty motors (i.e., explosion proof) are not required to meet efficiencies listed in the following table (in %):

Motor Horsepower	Nominal Efficiency (%)	Motor Horsepower	Nominal Efficiency (%)
½ and ¾	84.0	25 and 30	93.6
1	85.5	40 and 50	94.1
1½	86.5	60	94.5
2	87.5	75	95.0
3	89.5	100 and 125	95.4
5	90.2	150 and 200	95.8
7½ and 10	91.0	Over 200	96.2
15 and 20	92.4	–	–

- E. Provide thermal overload/disconnect switch.
- F. Provide single-phase manual motor starter with quick-make, quick-break toggle mechanism and field-adjustable overload heater element. Manual motor starters shall be sized for the motors served and specified under Division 23.
- G. Individual motor controller in a self-contained unit in a NEMA 1 enclosure (NEMA 3R gasketed where installed outdoors or where exposed to water spray, dust or dirt), externally operable from the front.

**END OF SECTION 23 05 13**

## SECTION 23 09 00

### AUTOMATIC CONTROL

#### PART 1 - GENERAL

##### 1.1 DESCRIPTIONS

- A. Automatic control work shall include all needed unit controllers, temperature sensors, alternators, actuators, etc. necessary to achieve the intended control of the indicated equipment and the sequences. Control contactor is responsible for final sequences and providing all necessary components, interfaces, etc. to achieve a working system.
- B. All controls work shall include wiring and complete testing.
- C. Standalone Direct Digital Control (DDC) controller and field panels, including sensors, and control devices as required.
- D. Complete electrical installation including wiring, raceways and power wiring, except as noted.
- E. Software as required to effect a complete and operational control system as specified herein.
- F. Complete operating and maintenance manuals and field training of operators and maintenance personnel.
- G. System commissioning and acceptance tests.
- H. Review of fire alarm shop drawing for acceptance by BMS contractor to ensure proper coordination of scope of work, wiring and operating sequences.
- I. Miscellaneous control wiring including, but not limited to:
  - 1. Wiring of thermostats
  - 2. Interlock wiring and all necessary control components to support operation of the generator related dampers and the start / stop sequence.
  - 3. Power wiring from designated Division 16 outlets to BMS components that require power.

#### PART 2 - SENSORS AND SWITCHES

- A. Temperature Sensors:
  - 1. Temperature sensor assemblies shall consist of a 100- or 1,000-OHM platinum RTD sensor and a solid state, 2-wire, 4 to 20 milliamp transmitter protected in a housing suitable for the environment in which it is installed.
  - 2. Sensor accuracy shall be plus or minus 1° F.
- B. Damper End Switch:
  - 1. Shall be oil-tight, roller type, single pole double throw snap-acting switch. Mechanism to provide ample overtravel to prevent stress on damper and control equipment.

2. Acceptable Manufacturers: Furnas Electric, Allen Bradley, Telemecanique.

C. Automatic Dampers:

1. Provide automatic dampers as indicated on Contract Drawings.
2. Dampers shall be low leakage type, with published leakage data certified under the AMCA Certified. Leakage through a 48-inch by 48-inch damper at 4 inches water gauge pressure difference shall be less than 6.2 cubic feet per minute per square foot of damper.

D. Electric Damper Operators:

1. Damper actuator shall stroke by rotating motion of a silently operating, reversible, overload protected synchronous motor. Crank arm shall be actuated directly with no intermediate linkage.
2. Provide one actuator for 16 square feet of damper area or as recommended by the manufacturer, whichever is the more stringent. Provide additional actuators to meet the damper leakage requirement. Damper actuator shall stroke from fully open to close or vice versa in less than 2 minutes.
3. Modulating actuator shall be the push-pull type. Two position damper shall have spring return.

**END OF SECTION 23 09 00**

## SECTION 23 09 93

### AUTOMATIC CONTROL SEQUENCES

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION

- A. Supply and install necessary software, programming, sensing, controlling and controlled devices, piping, wiring and commissioning of automatic control systems, so as to provide a complete control system, meet requirements of control sequences specified.

##### 1.2 GENERAL

- A. Contractor shall provide customized control strategies and control sequences and be able to define appropriate control loop algorithms and choose the optimum loop parameters for loop control. All control loops shall be tuned to stabilize within  $\pm 1\%$  of setpoint within 5 minutes of setpoint change or startup.
- B. Safety devices shall be hardware interlocked with "hand" and "automatic" positions in series with motor controller holding circuit.
- C. Smoke control, fire and life safety sequences shall override other automatic control sequences including hardwired safety devices.
- D. Reset schedules and setpoints shown in sequences are for initial programming and start up, during system commissioning the reset schedules and setpoints shall be fine tuned to obtain desired comfort, energy and life safety system results.
- E. The output of the reset schedules should be limited between maximum and minimum values. The intent of the reset schedules indicated is that the range of the output be limited between the minimum and maximum values indicated in the reset schedules.
- F. All functions which use analog points to switch equipment on and off (e.g., fans, pumps) must be programmed with dead bands, and if necessary, time delays to prevent short cycling of equipment.

##### 1.3 EXHAUST FANS

- A. Design Setpoint
  - 1. Summer: 95 °F
  - 2. Winter: 70 °F
- B. Start Stop Control:
  - 1. Exhaust fans shall be started automatically based on space temperature from the associated space thermostat.
- C. Operation:
  - 1. The fan shall be based on space temperature and the exhaust and inlet air damper shall be open.
- D. Warm Up/Cool Down Staging:

1. Exhaust fans shall stage on in a lead lag series to maintain the space temperature set point. The lead fan shall start when the space temperature is 5 deg F above set point for 2 minutes (adj.). With the lead fan operating, if the space temperature is rising above set point for 2 minutes (adj.) the second fan shall start and run until the space temperature is at or below set point with a minimum run time for 2 minutes (adj.). The first fan shall continue to run until the space temperature is at or below set point for 5 minutes (adj.)

#### 1.4 SPACE TERMINAL HEATING UNITS

- A. Setpoints:
  1. Summer/ Winter: 65 °F
- B. Start Stop Control:
  1. Start: Automatically when generator starts
  2. Stop: Space temperature sensor at or above heating setpoint
- C. Operation:
  1. Upon a call for heating, the electric heater shall energize to maintain space temperature heating setpoint.
  2. When the system is called to stop, the system shall revert to “Off” state.

#### 1.5 GENERATOR OPERATION

- A. System Off:
  1. Exhaust dampers and inlet air dampers closed.
  2. Exhaust fans stopped and exhaust fan dampers closed.
- B. System Start:
  1. Automatically when generator starts.
- C. System Operation:
  1. When the emergency generator is energized, the exhaust air dampers and inlet dampers shall open.
  2. Exhaust fan dampers to open and exhaust fans to start and run.
- D. System Stop:
  1. Automatically after generator stops AND when space temperature is at or below setpoint described in Exhaust Fan automatic control sequence.
  2. When the system is called to stop, the system shall revert to that “Off” state as described above.
- E. Safeties:
  1. In the event of a BMS component failure or loss of control power:
  2. Exhaust and make-up air dampers shall fail open.

**END OF SECTION 23 09 93**

## SECTION 23 31 00

### DUCTWORK

#### PART 1 - GENERAL

##### 1.1 STANDARDS

- A. Published specifications standards, tests or recommended methods of trade, industry or governmental organizations apply to work in this section where cited below:
  - 1. ASHRAE – American Society of Heating, Refrigeration and Air Conditioning Engineers Handbooks (Latest Editions).
  - 2. SMACNA – Sheet Metal and Air Conditioning Contractors National Association, Inc.
  - 3. HVAC Duct Construction Standards, Metal and Flexible, Second Edition, 1995.
  - 4. Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems, Fourth Edition, 1992.
  - 5. HVAC Systems Testing Adjusting and Balancing.
  - 6. Seismic Restraint Manual.

##### 1.2 DUCT CLASSIFICATION

- A. Duct classification is based on pressure classification as scheduled in Table 1-1 and as described in the 2005 SMACNA HVAC Duct Construction Standards (Metal and Flexible). Comply with NFPA 90A when ducts traverse through smoke zones. Comply with UBC/UMC when more stringent than NFPA 90A or SMACNA standards.
- B. Minimum operating pressure for each duct system:
  - 1. Scheduled external static pressure for each fan or HVAC unit, positive or negative.
  - 2. Adjust upward to nearest pressure class tabulated in SMACNA HVAC Duct Construction Standards.
- C. Duct classification is applicable to all ductwork, including but not limited to the following:
  - 1. Outside air supply systems (+1" w.g.).
  - 2. Relief, return and exhaust systems (-2" w.g.).

##### 1.3 MATERIALS

- A. Sheet Metal:
  - 1. Steel sheets:
    - a. Cold rolled steel sheets, lock forming quality.
    - b. Meeting ASTM A-653 and A-653M.
    - c. Black or galvanized as specified.
    - d. Galvanizing: 1/4 ounce per sq. ft., total both sides.
  - 2. Stainless steel sheets:
    - a. ANSI Type 316 as specified.
    - b. Concealed: Finish No. 2B or No. 3.
    - c. Exposed: Finish No. 4.
- B. Miscellaneous Products:

1. Duct Sealants:
    - a. Sealing compound: shall be flexible after based adhesive for use in all pressures, UV resistant, NFPA Class 7 ductwork.
    - b. Gaskets:
      - 1) Continuous, reinforced, inert self-conforming type.
      - 2) 1/8-inch thick.
      - 3) Width: to match angle connection.
      - 4) Ductmate Industries Model 440, or equal.
  2. Hard-setting joint tape:
    - a. Two-part tape:
      - 1) Mineral impregnated woven fiber tape.
      - 2) Impregnated with activator/adhesive of polyvinyl acetate type.
    - b. UL listed:
      - 1) Flame spread: 10.
      - 2) Smoke developed: 0.
    - c. Similar to Hardcast□.
- C. Slide-on Transverse Joint Connectors:
1. Prefabricated slide-on transverse duct connectors and components shall be accepted. Ducts constructed using prefabricated systems shall refer to the manufacturer guidelines for sheet gauge, intermediate reinforcement size and spacing, and proper joint reinforcement. Ductmate Industries, Ward, Nexus, or approved equal.
  2. Formed-on flanges shall be constructed as T-25 A/B flanges, of which the construction guidelines are given in Figure 1-4 of the 1995 SMACNA HVAC Duct Construction Standards, Metal and Flexible, Second Edition. No other construction standards pertaining to formed-on flanges shall be accepted.
  3. Formed-on flanges shall include the use of corners, bolts, cleat and gasket.
  4. All components shall be metal unless other materials are required by code or specified.
- D. Flexible Connections:
1. With metal edges at each end:
    - a. No. 24 USSG galvanized steel.
  2. 2 inch slack in fabric.
  3. Install to allow minimum movement of 1 inch.
  4. Length of fabric connections:
    - a. Minimum: 2 inches.
    - b. Maximum: 6 inches.
  5. Materials:
    - a. Indoor installations shall be a UL listed, fire retardant neoprene or vinyl coated woven fiberglass fabric. Minimum density 30 ounces per square yard and rated to 200□ F.
    - b. Outdoor installations shall be a UL listed ultra violet light resistant Hypalon coated woven fiberglass fabric. Minimum density 24 ounces per square yard and rated to 250□ F.
    - c. Flame spread rating: 25 maximum, smoke developed rating: 50 maximum
    - d. Insulated connections:
    - e. Two layers of fabric with 1-inch thick fiberglass, 1.5 pound density.
    - f. Performance as previously specified in 2.2-C-5-b.
    - g. Provide wire embedded uncoated glass fabric with sewn seams for air temperature over 150□ F.

## 1.4 ACCESS DOORS

- A. In accordance with SMACNA – Duct Construction Standards except as noted.
- B. In ductwork:
  - 1. Insulated or non-insulated, same as duct.
  - 2. Hinged, except where sliding or removable type required. Latch, equal to Ventlok No. 100.
  - 3. Size:
    - a. 36 inches x 36 inches.
  - 4. Provide in following locations:
    - a. Exhaust Plenum
  - 5. Make completely accessible.

## 1.5 DUCTWORK INSTALLATION

- A. General:
  - 1. Duct dimensions indicated are net, inside, clear, dimensions:
  - 2. For internally lined ducts, add lining thickness to determine metal duct for dimensions.
  - 3. At exposed duct penetrations of walls, floors and ceilings, provide sheet metal angle type escutcheons.
  - 4. Transitions:
    - a. Pitch sides of duct in “diverging” or “converging” airflow maximum of 15° including angle.
  - 5. Duct openings:
    - a. Provide openings where required to accommodate thermometers, smoke detectors, controllers, etc.
      - 1) Insert through airtight rubber grommets.
    - b. At fire dampers allow adequate length of duct to install access door.
- B. Rectangular Duct Joints:
  - 1. Standing seams, except where flush drive slip seam called for.
  - 2. Use flush, drive-slip, for:
    - a. Exposed ducts.
    - b. Where required for clearance.
  - 3. “Ductmate” system joints, may be used in lieu of standing seams. (PLASTIC CLIPS ARE NOT ALLOWED).
- C. Joint Sealing:
  - 1. Seal all transverse, longitudinal and spiral joints of all sheet metal ducts by one of following methods:
    - a. Six ounce canvas strip, six inches wide.
      - 1) Adhere with lagging adhesive. Hardcast PS-S tape (DUCT TAPE NOT ALLOWED).
    - b. United Hi-Velocity sealer.
    - c. Applications as recommended by manufacturer.
  - 2. Seal punched holes and corner cracks (DUCT TAPE NOT ALLOWED).
  - 3. After installation and testing reseal joints found to be leaking.

1.6 Installation of Wiring:

- A. Provide wiring for control devices, monitoring devices, instrumentation, and interlocks as required for a complete system. Coordinate with Division 21, 22, 23, 26 and 27 specifications for devices requiring wiring under this Section.
- B. Run all wiring in compliance with the requirements of the electrical specifications (Division 26) and in accordance with authorities and codes having jurisdiction. Provide separate conduit for control wiring under this Section.
- C. Control wiring, power or signal shall be run in metallic conduit.
- D. Provide all BMS wiring, including power wiring to DDCs and BMS equipment. All power wiring for control system shall be from an emergency power panel.

1.7 Fire Dampers:

- A. Provide static and dynamic fire dampers at exhaust fan inlets. Dampers shall be factory marked for static or dynamic use.

1.8 Automatic Dampers

- A. Install automatic control dampers of louver pattern including smoke dampers and fire/smoke dampers, as indicated on the DP drawings or as specified in intake ducts and/or plenums, discharge ducts and plenums from fans, etc. These dampers shall be provided by the automatic control contractor.

**END OF SECTION 23 31 00**

## **SECTION 23 33 13**

### **DAMPERS**

#### **PART 1 - GENERAL**

##### 1.1 Fire Dampers:

- A. Provide static and dynamic fire dampers at exhaust fan inlets. Dampers shall be factory marked for static or dynamic use.

##### 1.2 Automatic Dampers

- A. Install automatic control dampers of louver pattern including smoke dampers and fire/smoke dampers, as indicated on the Drawings or as specified in intake ducts and/or plenums, discharge ducts and plenums from fans, etc. These dampers shall be provided by the automatic control contractor.

**END OF SECTION 23 33 13**

## SECTION 23 34 00

### FANS

#### PART 1 - GENERAL

##### 1.1 ALL FANS

- A. Provide fans that are quiet operating and non-overloading the entire range of operation.
- B. Statically and dynamically balance fan wheels/impellers at the factory and certify balance.
- C. Provide precision self-aligning bearings designed to prevent leakage of oil or grease. Provide cups, oil chambers, Zerk or Alemite lubrication fittings in accessible locations for ease of lubrication.
- D. Provide copper lubrication leads, for lubrication of internal motors and bearings, extending to a capped termination point external to the fan casing or air handling unit.
- E. Extend wire leads on fans driven by direct motor drive from the motor junction box in air tight rigid walled conduit, to a junction box mounted external to the fan casing.
- F. On fans driven by belt drive provide standard "V-groove" type belts and sheaves suitable for the service intended. Fan sheaves are non-adjustable type with removable machined bushings. Provide adjustable pitch type with removable machined bushings. Provide adjustable pitch type motor sheaves with double locking feature, to 10 % above and below the rated fan speed. Dynamically balance sheaves with over three grooves. Provide at least two belts and sheaves each capable of carrying the entire load with one belt broken.
- G. Provide performed expanded metal or sheet metal belt guards, with grommets tachometer ports at the fan and motor shafts, for all exposed sheaves and belts. Belt guard shall comply with OSHA requirements and be easily removable.
- H. Construct wheels/impellers exposed to normal atmospheres of cast aluminum or hot dip galvanized steel and finished with two layers of factory applied non-scaling paint.
- I. Electrically ground all fans and drives to prevent accumulation of static charge. Indicate grounding method in fan submittals.
- J. Provided threaded drain plugs at fan housing low points.
- K. Fan wheels/impellers and housings shall be relieved of residual stresses produced in the forming process.
- L. Provide housings with integral inlet and discharge flanges, complete with bolt holes for flexible or hard duct connections. Shop fabricate any companion flanges required for connections to sound attenuators. Companion flanges shall be rolled angles matched to both fan housing and sound attenuators.

##### 1.2 ACCEPTABLE MANUFACTURERS

- A. Propeller Fans: Twin City, Bayley, Woods, Loren Cook, Greenheck

### 1.3 AXIAL FAN

- A. Propeller Type:
- B. Include propeller type impellers, complete with motors, and panel- or ring-mountings.
- C. Vary fan blades in camber and twist from base to tip.
- D. Construct impellers of die-formed steel or aluminum with a welded reinforcing gusset on the backside for added rigidity, attached to a central hub mounted on the fixed drive shaft. Fan shall be of welded and bolted construction utilizing corrosion-resistant fasteners.
- E. Rotate fan hub on the fixed drive shaft using sealed ball bearings with a L10 life of 100,000 hours.
- F. To eliminate overhang load on belted fans, design to apply belt load to the hub in the same plane as the bearings.
- G. Direct drive fans are only acceptable where belt-driven units do not meet the performance criteria or direct drive is specified.
- H. Provide panels or rings with spun venturi inlets suitable for wall-mounting and structural angle supports of welded steel construction.
- I. Provide basket type fan guards for exposed inlets and discharges.
- J. Provide TEFC motors on all fans.
- K. Provide factory-fabricated wall sleeves.
- L. Provide factory-fabricated 45 deg exhaust hood.

**END OF SECTION 23 34 00**

## SECTION 23 82 05

### SPACE TERMINAL HEATING UNITS

#### PART 1 - GENERAL

##### 1.1 ACCEPTABLE MANUFACTURERS

- A. Electric Cabinet Heaters and Unit Heaters: Trane, Markel, Brasch, Marley

##### 1.2 UNIT HEATERS – PROPELLER FAN TYPE

- A. Provide propeller type unit heaters with heater elements, motor-driven propeller type fans, all installed in a minimum 20-gauge formed steel casing, finished with baked enamel paint.
- B. Motor speeds shall not exceed 1,500 high-speed revolutions per minute. Remove and replace any unit heaters, which are objectionably noisy.
- C. Provide an “On/Off” switch, overload protection and a 120-volt thermostat.
- D. The heaters shall be controlled automatically by means of thermostats, to start and stop the fans. The thermostats shall be adjustable and designed to operate on a 3-degree F differential over a temperature range of approximately 20 degrees F to 75 degrees F.
- E. Each unit heater shall be properly isolated and supported from building construction and be provided with seismic restraints to prevent sway.
- F. Hydronic Heating Units: Provide copper tube/aluminum fin heating elements. Install an aquastat in the supply connection to each heater, wired to prevent the fan from operating when there is no heat available. Unit heaters shall be supported independently of the piping to which they are connected.
- G. Electric Heating Units: Provide heating elements of sheathed nickel-chromium wire.

##### 1.3 INSTALLATION

- A. Provide shut-off and isolation valves, balancing cocks and manual air vent for each radiator, convector, cabinet/unit heaters or finned tube element.
- B. Install radiators, convectors and cabinet/unit heaters as detailed on the architectural drawings and follow manufacturer’s instructions.
- C. All piping and control valves serving radiators, convectors and cabinet/unit heaters shall be concealed or installed within empty sections of radiator cabinet.

**END OF SECTION 23 82 05**

## SECTION 26 05 01

### ELECTRICAL GENERAL PROVISIONS

#### PART 1 – GENERAL

##### 1.1 DESCRIPTION

- A. The General and Supplementary Conditions and other Divisions are a part of the requirements for the work under this Division of the Specifications.
- B. It is the intent of these Specifications to provide complete systems. Completeness shall mean that all materials, equipment, and systems as installed and operating on this project have been installed properly with the best practices of the trade; are suitable for the intended purpose, location, and environment; properly fit within the physical space limitations for the project; are in conformance with applicable codes and reference standards; have been started-up, tested, adjusted, and commissioned for the intended use; have maintained applicable UL Listings; are in compliance with manufacturer's recommendations and warranty requirements; ready for the Owner's use, and in the opinion of the engineer, performing as designed.

##### 1.2 WORK INCLUDED

- A. Provide labor and materials required to install, test and place into operation the electrical systems as called for in the Contract Documents, in accordance with applicable codes and regulations and in accordance with the equipment manufacturers written directions.
- B. Provide labor, materials, and accessories required to provide complete, operating electrical systems. Labor, materials, or accessories not specifically called for in the Contract Documents, but required to provide complete, operating electrical systems shall be provided without additional cost.

##### 1.3 QUALITY ASSURANCE

- A. Comply with the current applicable codes, ordinances, and regulations of the Authority or Authorities Having Jurisdiction, the rules, regulations, and requirements of the utility companies serving the project, and the Owner's insurance underwriter.
- B. Drawings, specifications, codes and standards are minimum installation requirements. Where requirements differ, the most stringent apply.
- C. Should any change in drawings or specifications be required to comply with governing regulations, notify the Engineer prior to submitting bid.
- D. All electrical equipment, materials, devices, and installations shall meet or exceed minimum requirements of ADA, ANSI, ASTM, IEEE, IES, NEC, NEMA, NETA, NFPA, OSHA, SMACNA and UL.
- E. Execute work in strict accordance with the best practices of the trades in a thorough, substantial, workperson-like manner by competent workpeople. Provide a competent, experienced, full-time Superintendent who is authorized to make decisions on behalf of the Contractor.

- F. Equipment shall be certified for use in the District of Columbia and shall meet the local energy code.

#### 1.4 ABBREVIATIONS AND DEFINITIONS

##### A. Abbreviations:

1.	ADA	Americans with Disabilities Act
2.	ANSI	American National Standards Institute
3.	ASA	Acoustical Society of America
4.	ASTM	American Society for Testing and Materials
5.	BIL	Basic Impulse Level
6.	CBM	Certified Ballast Manufacturers
7.	ECC	Engineer's Control Center
8.	EIA	Electronic Industries Alliance
9.	ETL	Electrical Testing Laboratories, Inc.
10.	FCC	Fire Control Center
11.	FM	Factory Mutual
12.	IEEE	Institute of Electrical and Electronic Engineers
13.	IES	Illuminating Engineering Society
14.	IPCEA	International Power Cable Engineers Association
15.	LED	Light Emitting Diode
16.	NEC	National Electrical Code
17.	NEMA	National Electrical Manufacturers Association
18.	NETA	National Electrical Testing Association
19.	NFPA	National Fire Protection Association
20.	OEM	Original Equipment Manufacturer
21.	OSHA	Occupational Safety and Health Administration
22.	SCC	Security Control Center
23.	SMACNA	Sheet Metal and Air Conditioning Contractors National Association
24.	TIA	Telecommunications Industry Association
25.	UL	Underwriters Laboratories Inc.

##### B. Definitions:

1. Where it is stated in these specifications to submit to the Engineer for review, refer to General and Supplementary Conditions for proper procedures.
2. FURNISH means to supply all materials, labor, equipment, testing apparatus, controls, tests, accessories, and all other items customarily required for the proper and complete application.
3. INSTALL means to join, unite, fasten, link, attach, set up or otherwise connect together before testing and turning over to Owner, complete and ready for regular operation.
4. PROVIDE means to FURNISH and INSTALL.
5. AS DIRECTED means as directed by the Engineer, or the Engineer's Representative.
6. CONCEALED means embedded in masonry or other construction, installed behind wall furring or within drywall partitions, or installed above suspended ceilings.
7. SUBMIT means submit to Engineer for review.

#### 1.5 GUARANTEE

- A. Submit a single guarantee stating that the work is in accordance with the Contract Documents. Guarantee work against faulty and improper material and workmanship for a

period of one year from the date of final acceptance by the Owner, except that where guarantees or warranties for longer terms are provided or specified herein, the longer term shall apply. Correct any deficiencies, which occur during the guarantee period, within 24 hours of notification, without additional cost. Obtain similar guarantees from subcontractors, manufacturers, suppliers and sub-trade specialists.

#### 1.6 USE OF THE ENGINEER'S AND ENGINEER'S DRAWINGS

- A. The Contractor may obtain from the Engineer a set of 3D BIM or compatible format engineering drawings on electronic media where desired by the Contractor and/or required by the Specifications for use in preparing the shop drawings, coordination drawings, and record drawings. The Contractor shall provide to the Engineer a written or electronic release of liability acceptable to the Engineer prior to receiving the electronic media.

### **PART 2 – PRODUCTS**

#### 2.1 EQUIPMENT AND MATERIALS

- A. Provide products and materials that are new, clean, free of defects, and free of damage and corrosion.
- B. Products and materials shall not contain lead, asbestos, PCB, or any other material that is considered hazardous by the Environmental Protection Agency or any other Authority Having Jurisdiction.
- C. Replace materials of less than specified quality and relocate work incorrectly installed as directed by the Engineer at no additional cost.
- D. Provide name / data plates on major components of equipment with manufacturer's name, model number, serial number, capacity data and electrical characteristics attached in a conspicuous place.
- E. Install materials and equipment with qualified trades people.
- F. Maintain uniformity of manufacturer for equipment used in similar applications and sizes.
- G. Fully lubricate equipment where required.
- H. Follow manufacturer's instructions for installing, connecting, and adjusting equipment. Provide a copy of such instructions at the equipment during installation.
- I. Equipment capacities, ratings, etc., are scheduled or specified for job site operating conditions. Equipment sensitive to altitude shall be derated with the method of derating identified on the submittals.
- J. Enclosures for electrical equipment installed indoors in mechanical or electrical equipment rooms shall be NEMA type 1. Enclosures for electrical equipment installed outdoors shall be NEMA type 3R – gasketed or as specified on the drawings.
- K. Energy consuming equipment shall be certified for use in the District of Columbia and shall meet the local energy code and local energy ordinances.

## 2.2 SUBSTITUTIONS

- A. Contract Documents are based on equipment manufacturers as called out in the Specifications and indicated on the Drawings. Contract documents include a basis of design in which the design is centered. Other manufacturers listed in the specification are acceptable if the equipment fits in the designated area without altering the engineering design and meets other clauses in the specifications. Acceptance of substitute equipment manufacturers does not relieve Contractor of the responsibility to provide equipment and materials, which meet the performance as, stated or implied in the Contract Documents.
- B. Submit proposals for review and approval, to provide substitute materials or equipment, in writing, fifteen business days prior to submission of bid. Substituted materials or equipment received after that time will not be acceptable or reviewed. Reimburse Owner for costs associated with the review of the proposed substitution whether substitution is accepted or rejected.
- C. Indicate revisions required to adapt substitutions including revisions by other trades. Substitutions that increase the cost of the work and related trades are not permitted or shall be paid for by the contractor.
- D. The proposed substitution shall conform to the size, ratings, and operating characteristics of the equipment or systems as specified and shown on the Drawings. The substitution must fit into available space conditions and must function properly in coordination with the rest of the system.
- E. Proposals for substitutions shall include the following information:
  - 1. A description of the difference between the Contract Document requirements and that of the substitution, the comparative features of each, and the effect of the change on the end result performance. Include the impact of all changes on other contractors and acknowledge the inclusion of additional costs to the other trades.
  - 2. Schematic drawings and details.
  - 3. List of revisions to the Contract Documents that must be made if the substitution is accepted.
  - 4. Estimate of added or reduced costs the Contractor may incur in implementing the substitution, such as test, evaluation, operating and support costs.
  - 5. Statement of the time by which a Contract modification accepting the substitution must be issued, noting any effect on the Contract completion time or the delivery schedule.
  - 6. A statement indicating the reduction to the Contract price if the Owner accepts the substitution. Include required modifications to all related trades.

## PART 3 – EXECUTION

### 3.1 FEES AND PERMITS

- A. Pay all required fees and obtain all required permits related to the electrical installation.
- B. Pay royalties or fees in connection with the use of patented devices and systems.
- C. Provide controlled inspection where required by Authorities Having Jurisdiction or by these specifications.

### 3.2 SUBMITTALS AND REVIEWS

- A. Submit shop drawings, manufacturer's product data sheets, samples, and test reports as specified.
- B. Submit a complete typed list of all electrical equipment manufacturers and material suppliers for the equipment proposed to be provided on this project, as well as names of all subcontractors.
- C. Prepare an index of all submittals for the project. Include a submittal identification number, a cross-reference to the Specification sections or Drawing number, and an item description. Prefix the submittal identification number by the Specification sections to which they apply. Indicate on each submittal, the submittal identification number in addition to the other data specified. All subcontractors shall utilize the assigned submittal identification number.
- D. After the Contract is awarded, obtain complete shop drawings, product data and samples from the manufacturers, suppliers, vendors, and all subcontractors, for all materials and equipment as specified. Submit data and details of such materials and equipment for review. Prior to submission, certify that the shop drawings, product data and samples are in compliance with the Contract Documents. Include as part of the Shop Drawing the specification section. Provide a compliance / non-compliance specification attached to the front of every submittal. Identify each paragraph stating the submittal complies with the specification or does not comply. For every statement of non-compliance, include clear language as to the reason for the non-compliance and the submitted provisions that are intended to operate in its place. Submittals without the required compliance / non-compliance specification attached will not be reviewed and will be returned "Review and Resubmit". Check all materials and equipment upon their arrival on the job site and verify their compliance with the Contract Documents. Modify any work, which proceeds prior to receiving accepted shop drawings as required to comply with the Contract Documents and the shop drawings.
- E. Non applicable items in the specifications shall be clearly stricken out. Applicable items shall be clearly highlighted. Submittals lacking the clarity of stricken or highlighted information shall be returned marked Revise and Resubmit.
- F. Review of submittals is for general compliance with the design concept and Contract Documents. Comments or absence of comments shall not relieve the Contractor from compliance with the Contract Documents. The Contractor remains solely responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of construction, for performing the work in a safe manner, and for coordinating the work with that of other trades.
- G. No part of the work shall be started in the shop or in the field until the shop drawings and samples for that portion of the work have been submitted reviewed, and returned with either "No Exceptions Noted" or "Exceptions Noted" marked on the submission.
- H. A minimum period of ten working days, exclusive of transmittal time, will be required in the Engineer's office each time a shop drawing, product data and/or samples are submitted for review. This period must be considered by the Contractor in the scheduling of the work.
- I. Submit electronic submittals of the shop drawing or product data as PDF electronic files in compliance with the Division 1 requirements. All electronic submittals shall include the

associated cover sheet and submittal number. Submit all material samples with the appropriate cover sheet and sample number.

J. Submissions will be stamped as follows:

Stamp		Interpretation
<input type="checkbox"/>	No Exceptions Noted	Fabrication, manufacture, or construction may proceed providing submittal complies with the Contract Documents.
<input type="checkbox"/>	Exceptions Noted: Resubmit for Record	Fabrication, manufacture, or construction may proceed providing submittal complies with both the Contract Documents and the Engineer's notations. Resubmit revised submittal for record only.
<input type="checkbox"/>	Exceptions Noted: No Resubmission Required	Fabrication, manufacture, or construction may proceed providing submittal complies with both the Contract Documents and the Engineer's notations.
<input type="checkbox"/>	Revise and Resubmit	Submittal does not comply with the Contract Documents. Do not proceed with fabrication, manufacture, or construction. The work and/or shop drawings are not permitted at the job site.
<input type="checkbox"/>	For Review Only	Informational Submittal: Submittal does not require the Engineer's responsive action.

K. Submit materials and equipment by manufacturer, trade name, and model number. Include copies of applicable brochure or catalog material. Maintenance and operating manuals are not acceptable substitutes for shop drawings.

L. Identify each sheet of printed submittal pages (using arrows, highlighting, underlining or circling) to show applicable sizes, types, model numbers, ratings, capacities and options actually being proposed. Cross out non-applicable information. Note specified features such as materials or paint finishes. Cross out all references to "options". Cross out statements such as "subject to change without notice" or "not for construction". Anything not specifically excluded is assumed to be included. Submittals that do not clearly indicate excluded information will not be reviewed and will be returned marked "Revise and Resubmit".

M. Include dimensional data for roughing in and installation and technical data sufficient to verify that equipment meets the requirements of the Contract Documents. Include wiring, conduit routing and service connection data.

N. Maintain a complete set of reviewed and stamped shop drawings and product data on site.

O. For each room or area of the building containing electrical equipment, submit the following:

1. Floor Plans: Plan and elevation layout drawings indicating the equipment in the exact location in which it is intended to be installed. These plans shall be of a scale not less than 1/4 inch to 1 foot. They shall be prepared in the following manner:

- a. Indicate the physical boundaries of the space including door swings and ceiling heights and ceiling types (as applicable).

- b. Illustrate all electrical equipment proposed to be contained therein. Include top and bottom elevations of all electrical equipment. The Drawings shall be prepared utilizing the dimensions contained in the individual equipment submittals. Indicate code and manufacturer's required clearances and access points.
  - c. Illustrate all other equipment therein such as conduits, detectors, luminaries, ducts, registers, pull boxes, wireways, structural elements, etc.
  - d. Indicate the operating weight of each piece of equipment.
  - e. Indicate the heat release from each piece of electrical equipment in terms of BTU per hour. This information shall be that which is supplied by the respective manufacturers.
  - f. Illustrate concrete housekeeping pads and curbs.
  - g. Indicate dimensions to confirm compliance with code-required clearances.
  - h. Indicate maximum normal allowable operating temperature for each piece of equipment (as per each respective manufacturer's recommendation).
  - i. Equipment removal routes.
2. Provide ¼" = 1'-0" plans of point-to-point routing of conduits with size and function between switchboards, transformers, panelboards, distribution boards, transfer switches, maintenance panels, generators, protective relaying, generator control cabinets etc. All conduit 2" in diameter and greater shall be indicated in the model.
- P. The work described in shop drawing submissions shall be carefully checked by all trades for clearances (including those required for maintenance and servicing), field conditions, maintenance of engineering conditions and coordination with other trades on the job. Each submitted shop drawing shall include a certification that related job conditions have been checked by the Contractor and each Subcontractor and that conflicts do not exist.
- Q. The Contractor is not relieved of the responsibility for dimensions or errors that may be contained on submissions, or for deviations from the requirements of the Contract Documents. The noting of some errors but overlooking others does not grant the Contractor permission to proceed in error.
- R. Inadequate or incomplete shop drawings, product data and/or samples will not be reviewed and will be returned to the Contractor marked "Revise and Resubmit" for resubmittal.
- S. Indicate the following on the lower right-hand corner of each shop drawing and on the front cover of each product data brochure cover: The submittal identification number; title of the sheet or brochure; name and location of the project; names of the Engineer, Engineer, Contractor, Subcontractor, manufacturer, supplier, and vendor; the date of submittal; and the date of each correction, version and revision. Number all pages and drawings in product data brochures consecutively from beginning to end. Unless the above information is included, the submittal will be returned for resubmission. Resubmittals of product data or brochures shall include a cover letter summarizing the corrections made in response to the review comments.

### 3.3 COORDINATION OF WORK

- A. The Contract Documents establish scope, materials and quality but are not detailed installation instructions. Drawings are diagrammatic.

- B. Coordinate work with related trades and furnish, in writing, any information necessary to permit the work of related trades to be installed satisfactorily and with the least possible conflict or delay.
- C. The electrical drawings show the general arrangement of equipment and appurtenances. Follow these drawings as closely as the actual construction and the work of other trades will permit. Provide offsets, fittings, and accessories, which may be required but not shown on the Drawings. Investigate the site, note construction conditions, wall materials, ceiling heights and review drawings of other trades to determine conditions affecting the work and provide such work and accessories as may be required to accommodate such conditions. Additional costs as a result of the failure to investigate the site will not be paid.
- D. The locations of receptacles, outlets, panels and other equipment indicated on the Drawings are approximately correct, but they are understood to be subject to such revision as may be found necessary or desirable at the time the work is installed in consequence of increase or reduction of the number of outlets, or in order to meet field conditions, or to coordinate with modular requirements of ceilings, or to simplify the work, or for other legitimate causes.
- E. Exercise particular caution with reference to the location of panels, receptacles, outlets, switches, fire alarm devices, and have precise and definite locations accepted by the Engineer before proceeding with the installation.
- F. The Drawings show only the general run of large raceways and approximate locations of receptacles and outlets. Any significant changes in location of receptacles and outlets, cabinets, etc., necessary in order to meet field conditions shall be brought to the immediate attention of the Engineer for review before such alterations are made. Modifications shall be made at no additional cost.
- G. Verify with the Engineer the exact location and mounting height of outlets and equipment not dimensionally located on the Drawings prior to installation.
- H. Circuit tags in the form of numbers are used where shown to indicate the circuit designation numbers in electrical panels. Show the actual circuit numbers on the as-built Record Drawings and on the associated typed panelboard directory card. Where circuiting is not indicated, provide required circuiting in accordance with the loading indicated on the Drawings and/or as directed.
- I. The Drawings generally do not indicate the quantity of wires in conduit for the branch circuit wiring of fixtures and outlets, or the actual circuiting. Provide the correct conductor size and quantity as required by the indicated circuiting and/or circuit numbers indicated, the control intent, referenced wiring diagrams (if any), the specified voltage drop or maximum distance limitations, and the applicable requirements of the NEC.
- J. Carefully check space requirements with other trades to ensure that equipment can be installed in the spaces allotted.
- K. Wherever work interconnects with work of other trades, coordinate with other trades to ensure that they have the information necessary so that they may properly install the necessary connections and equipment. Identify pull boxes requiring access in order that the ceiling trade will know where to install access doors and panels.
- L. Consult with other trades regarding equipment so that, wherever possible, motor controls and distribution equipment are of the same manufacturer.

- M. Furnish and set sleeves for passage of electrical risers through structural masonry and concrete walls and floors and elsewhere as required for the proper protection of each electrical riser passing through building surfaces.
- N. Provide firestopping matching the wall or partition rating around all pipes, conduits, ducts, sleeves, etc. which pass through rated walls, partitions and floors.
- O. Provide detailed information on openings and holes required in precast members for electrical work.
- P. Provide required supports and hangers for conduit and equipment, designed so as not to exceed allowable loadings of structures.
- Q. Examine and compare the Contract Documents with the drawings and specifications of other trades and report any discrepancies between them to the Engineer and obtain written instructions for changes necessary in the work. Install and coordinate the work in cooperation with other related trades. Before installation, make proper provisions to avoid interferences.
- R. Wherever the work is of sufficient complexity, prepare additional detail drawings to scale to coordinate the work with the work of other trades. Detailed work shall be clearly identified on the Drawings as to the area to which it applies. Submit these drawings to the Engineer for review. At completion include a set of these drawings with each set of Record Drawings.
- S. Furnish services of an experienced Superintendent, who shall be in constant charge of all work, and who shall coordinate work with the work of other trades. No work shall be installed before coordinating with other trades.
- T. Before commencing work, examine adjoining work on which this work is in any way affected and report conditions, which prevent performance of the work. Become thoroughly familiar with actual existing conditions to which connections must be made or which must be changed or altered.
- U. Adjust location of conduits, panels, equipment, etc., to accommodate the work to prevent interferences, both anticipated and encountered. Determine the exact route and location of each conduit prior to fabrication.
  - 1. Right-of-Way: Lines which pitch have the right-of-way over those which do not pitch. For example: condensate, steam, and plumbing drains normally have right-of-way. Lines whose elevations cannot be changed have right-of-way over lines whose elevations can be changed.
  - 2. Provide offsets, transitions and changes in direction of conduit as required to maintain proper headroom and pitch on sloping lines.
- V. In cases of doubt as to the work intended, or in the event of need for explanation, request supplementary instructions from the Engineer.
- W. Reflected Ceiling Plans: ceiling plans, sections, and other necessary details showing dimensioned layouts for equipment located in or on the ceiling plane. Base dimensions on exact dimensioned data obtained from product submittals for products to be included in the Work. Differentiate between field measurements and assumed dimensions. Include the following items coordinated with each other, based on input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members
3. Sprinklers, sprinkler mains.
4. Fire Alarm initiating and indicating devices,

### 3.4 CONTRACTOR'S COORDINATION DRAWINGS

- A. The Contractor shall coordinate efforts of all trades and shall provide (in writing, with copies to the Engineer) any information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay.
- B. The Contractor and all trade contractors shall prepare a complete set of construction Coordination Drawings indicating the equipment actually purchased and the exact routing for all lines such as conduit, piping, ductwork, etc., The Coordination Drawings shall be submitted complete to the Engineer, in compliance with the construction schedule for the project. The sheet metal drawings, at a scale of not less than 1/4 inch to 1 foot, shall serve as the base drawings to which all other Contractors shall add their work. Each separate trade contractor shall draw their work on separate layers or worksets with different color assignments to facilitate coordination. Each Coordination Drawing shall be completed and signed off by the other Trade Contractors and the Contractor prior to the installation of the mechanical, plumbing, electrical and fire protection and sprinkler work in the area covered by the specific drawing. The Contractor's work shall be installed according to the shop drawings and coordination drawings. If the Contractor allows one trade to install their work before coordination with the work of other trades, the Contractor shall make all necessary changes to correct the condition at no additional cost.
- C. The Contractors' Coordination Drawings shall indicate structural loads at support points for all piping 10 inch and larger, racked piping, racked conduit, busway, and suspended electrical equipment. Submit to Structural Engineer for review and approval. The elevation, location, support points, static, dynamic and expansion forces and loads imposed on the structure at support and anchor points shall be indicated. All beam penetrations and slab penetrations shall be indicated and sized and shall be coordinated. Work routed underground or embedded in concrete shall be indicated by dimension to column and building lines and shall be coordinated. Coordination Drawings shall document all required structural penetrations for initial construction. Penetrations shall be dimensioned for walls, floors and roofs. These structural coordination requirements require review and approval by the Structural Engineer prior to completion and submittal of the Drawings.
- D. This requirement for Coordination Drawings shall not be construed as authorization for the Contractor or trade contractors to make any unauthorized changes to the Contract Documents. Contract document space allocations shall be maintained such as ceiling height, designated clearance for future construction and flexibility, chase walls, equipment room size, unless prior written authorization is received from the Engineer to change them.
- E. Prior to final acceptance of the work, the Contractor shall submit the Coordination Drawings as part of the Record Drawings submittal.

### 3.5 EXAMINATION OF SITE

- A. Prior to the submitting of bids, visit the project site and become familiar with all conditions affecting the proposed installation and make provisions as to the cost thereof.

- B. The Contract Documents do not make representations regarding the character or extent of the existing structural, mechanical and electrical installations, above or below ground, or other sub-surface conditions which may be encountered during the work. Evaluate existing conditions, which may affect methods or cost of performing the work, based on examination of the site or other information. Failure to examine the Drawings or other information does not relieve the Contractor of responsibility for the satisfactory completion of the work.

### 3.6 CUTTING AND PATCHING

- A. Where cutting, channeling, chasing or drilling of floors, walls, partitions, ceilings or other surfaces is necessary for the proper installation, support or anchorage of conduit or other equipment, lay out the work carefully in advance. Repair any damage to the building, piping, equipment or defaced finished plaster, woodwork, metalwork, etc., using skilled tradespeople of the trades required at no additional cost.
- B. Do not cut, channel, chase or drill unfinished masonry, tile, etc., unless permission from the Engineer is obtained. If permission is granted, perform this work in a manner acceptable to the Engineer.
- C. Where conduit or equipment are mounted on a painted finished surface, or a surface to be painted, paint to match the surface. Cold galvanize bare metal whenever support channels are cut.
- D. Provide slots, chases, openings and recesses through floors, walls, ceilings, and roofs as required. Where these openings are not provided, provide cutting and patching to accommodate penetrations at no additional cost.

### 3.7 MOUNTING HEIGHTS

- A. Mounting heights shall conform to ADA requirements.
- B. Verify exact locations and mounting heights with the Engineer before installation.
- C. Electrical receptacles and outlets shall be mounted no higher than 48 inches above finished floor to top of the outlet box and no lower than 15 inches above finished floor to bottom of the outlet box.
- D. Electrical switches shall be mounted no higher than 48 inches above finished floor to top of the outlet box and no lower than 36 inches above finished floor to bottom of the outlet box.
- E. Fire alarm manual pull stations shall be mounted no higher than 48 inches above finished floor to top of the outlet box and no lower than 36 inches above finished floor to bottom of the outlet box.
- F. Visual Alarms: When not ceiling mounted, not less than 80 inches to the bottom or 96 inches to the top of the device.

### 3.8 CLEANING UP

- A. Avoid accumulation of debris, boxes, loose materials, crates, etc., resulting from the installation of this work. Remove from the premises each day all debris, boxes, etc., and keep the premises clean and free of dust and debris.

- B. All electrical equipment shall be thoroughly vacuumed and wiped clean prior to energizing and at the completion of the project. Equipment shall be opened for observation by the Engineer as required.

### 3.9 WATERPROOFING

- A. Avoid, if possible, the penetration of any waterproof membranes such as roofs, machine room floors, basement walls, and the like. If such penetration is necessary, make penetration prior to the waterproofing and furnish all sleeves or pitch-pockets required. Advise the Engineer and obtain written permission before penetrating any waterproof membrane, even where such penetration is shown on the Drawings.
- B. Restore waterproofing integrity of walls or surfaces after they have been penetrated without additional cost.

### 3.10 SUPPORTS

- A. Support work in accordance with the best industry practice. Provide supports, hangers, auxiliary structural members and supplemental hardware required for support of the work.
- B. Provide supporting frames or racks extending from floor slab to ceiling slab for work indicated as being supported from walls where the walls are incapable of supporting the weight. In particular, provide such frames or racks in electric closets and mechanical equipment rooms.
- C. Provide supporting frames or racks for equipment which is to be installed in a freestanding position.
- D. Supporting frames or racks shall be of standard angle, standard channel or specialty support system steel members, rigidly bolted or welded together and adequately braced to form a substantial structure. Racks shall be of ample size to assure a workmanlike arrangement of all equipment mounted on them.
- E. Adequate support of equipment (including outlet, pull and junction boxes and fittings) shall not depend on electric conduits, raceways, or cables for support.
- F. Electrical equipment or raceway shall not rest on or depend for support on suspended ceiling media (tiles, lath, plaster, as well as splines, runners, bars and the like in the plane of the ceiling). Provide independent support of electrical equipment. Do not attach to supports provided for ductwork, piping or work of other trades.
- G. Provide required supports and hangers for conduit, equipment, etc., so that loading will not exceed allowable loadings of structure. Electrical equipment and supports shall not come in contact with work of other trades.

### 3.11 FASTENINGS

- A. Fasten equipment to building structure in accordance with the best industry practice.
- B. Where weight applied to building attachment points is 100 pounds or less, conform to the following as a minimum:
  - 1. Wood: Wood screws.
  - 2. Concrete and solid masonry: Bolts and expansion shields.
  - 3. Hollow construction: Toggle bolts.

4. Solid metal: Machine screws in tapped holes or with welded studs.
  5. Steel decking or sub-floor: Fastenings as specified below for applied weights in excess of 100 pounds.
- C. Where weight applied to building attachment points exceeds 100 pounds, but is 300 pounds or less, conform to the following as a minimum:
1. At concrete slabs provide 24-inch by 24-inch by 1/2-inch steel fishplates on top with through bolts. Fishplate assemblies shall be chased in and grouted flush with the top of slab screed line, where no fill is to be applied.
  2. At steel decking or sub-floor for all fastenings, provide through bolts or threaded rods. The tops of bolts or rods shall be set at least one inch below the top fill screed line and grouted in. Suitable washers shall be used under bolt heads or nuts. In cases where the decking or sub-floor manufacturer produces specialty hangers to work with their decking or sub-floor, such hangers shall be provided.
- D. Where weight applied to building attachment points exceeds 300 pounds, coordinate with and obtain the approval of Engineer and conform to the following as a minimum:
1. Provide suitable auxiliary channel or angle iron bridging between building structural steel elements to establish fastening points. Bridging members shall be suitably welded or clamped to building steel. Provide threaded rods or bolts to attach to bridging members.
- E. For items, which are shown, as being ceiling-mounted at locations where fastening to the building construction element above is not possible, provide suitable auxiliary channel or angle iron bridging tying to the building structural elements.
- F. Wall-mounted equipment may be directly secured to wall by means of steel bolts. Groups or arrays of equipment may be mounted on adequately sized steel angles, channels, or bars. Prefabricated steel channels as manufactured by Kindorf or Unistrut are acceptable.

### 3.12 IDENTIFICATION

- A. Identify electrical equipment with permanently attached phenolic nameplates with 1/2-inch high white engraved lettering. Identification shall include equipment name or load served as appropriate. Nameplates shall be attached with zinc-plated screws. Peel-and-stick tape or glue-on type nameplates are prohibited.
1. Nameplates for equipment connected to the normal power system shall be black with white lettering.
  2. Nameplates for equipment connected to the emergency power system shall be red with white lettering.
  3. Nameplates for equipment connected to the UPS system shall be orange with white lettering.
  4. Equipment labels to indicate voltage, conductor phasing color code and power source (fed from) information.
- B. Cable tags shall be flameproof secured with flameproof non-metallic cord.
- C. Provide an engraved nameplate for each switch controlling loads, which are not local to the switch.

- D. Wherever raceways for future use are terminated outside of the building, stake the location with a 8-foot long, 4-inch by 4-inch clear pressure treated post a minimum of 4' below grade and 4' above grade.
- E. See individual Sections for additional identification requirements.

### 3.13 PROHIBITED LABELS AND IDENTIFICATIONS

- A. In all public areas, tenant areas, and similar locations within the project, the inclusion or installation of any equipment or assembly which bears on any exposed surface any name, trademark, or other insignia which is intended to identify the manufacturer, the vendor, or other source(s) from which such object has been obtained, is prohibited, unless otherwise approved by the Engineer.
- B. Required UL labels shall not be removed nor shall identification specifically required under the various technical sections of the Specifications be removed.

### 3.14 EQUIPMENT PADS AND ANCHOR BOLTS

- A. Provide concrete pads under all floor-mounted electrical equipment. Equipment pads shall conform to the shape of the piece of equipment it serves with a minimum 1-inch margin around the equipment and supports. Pads shall be a minimum of 4 inches high and made of a minimum 28 day, 2500 psi concrete reinforced with 6-inch by 6-inch 6/6 gauge welded wire mesh. Trowel tops and sides of pad to smooth finishes, equal to those of the floors, with all external corners bullnosed to a 3/4-inch radius. Seal concrete pads where not painted. Paint pads same as surrounding floor areas. Shop drawings stamped "NO EXCEPTIONS NOTED" shall be used for dimensional guidance in sizing pads.
- B. Provide galvanized anchor bolts for all equipment placed on concrete equipment pads, inertia blocks, or on concrete slabs. Provide bolts of the size and number recommended by the manufacturer of the equipment and locate by means of suitable templates. Equipment installed on vibration isolators shall be secured to the isolator. Secure the isolator to the floor, pad, or support as recommended by the vibration isolation manufacturer.
- C. Where equipment is mounted on gypsum board partitions, the mounting screws shall pass through the gypsum board and securely attach to the partition studs. As an alternative, the mounting screws may pass through the gypsum board and be securely attached to 6 inches square, 18 gauge galvanized metal backplates, which are attached to the gypsum board with an approved non-flammable adhesive. Toggle bolts installed in gypsum board partitions are not allowed.

### 3.15 DELIVERY, DRAYAGE AND HAULING

- A. Provide drayage, hauling, hoisting, shoring and placement in the building of equipment specified and be responsible for the timely delivery and installation of equipment as required by the construction schedule. If any item of equipment is received prior to the time that it is required, the Contractor shall be responsible for its proper storage and protection until the time it is required. Pay for all costs of drayage or storage.
- B. If equipment is not delivered or installed at the project site in a timely manner as required by the project construction schedule, the Contractor shall be responsible for resulting disassembly, re-assembly, manufacturer's supervision, shoring, general construction modification, delays, overtime costs, etc., at no additional cost.

### 3.16 EQUIPMENT AND MATERIAL PROTECTION

- A. Protect the work, equipment, and material of other trades from damage by work or workmen of this trade, and correct damaged caused without additional cost.
- B. Take responsibility for work, materials, and equipment until finally inspected, tested and accepted. Protect work against theft, injury, or damage, and carefully store material and equipment received on site, which is not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of obstructing material. Cover and protect equipment and materials from damage due to water, spray-on fireproofing, construction debris, etc. Store equipment sensitive to moisture damage in dry, heated spaces.
- C. Provided adequate means for fully protecting finished parts of materials and equipment against damage from whatever cause during the progress of the work until final acceptance. Protect materials and equipment in storage and during construction in such a manner that no finished surfaces will be damaged or marred, and moving parts are kept clean and dry. Do not install damaged items; take immediate steps to obtain replacement or repair.
- D. Lighting fixture troffers with parabolic reflectors shall be installed with factory-mounted plastic protective bags around parabolic reflector assembly. Remove protective bag just prior to occupancy.

### 3.17 TESTING OF ELECTRICAL SYSTEMS

- A. Comply with the project construction schedule for the date of final performance and acceptance testing, and complete work sufficiently in advance of the Contract completion date to permit the execution of the testing prior to occupancy and Contract close-out. Complete any adjustments and/or alterations, which the final acceptance tests indicate as necessary for the proper functioning of all equipment prior to the completion date. See individual Sections for extent of testing required.
- B. Provide a detailed schedule of completion indicating when each system is to be completed and outlining when field testing will be performed. Submit completion schedule for review within six months after the notice to proceed by Owner's Representative has been given. Update this schedule periodically as the project progresses.

### 3.18 OPERATING INSTRUCTIONS

- A. Provide the services of factory-trained specialists to provide an operating instructions seminar for equipment and systems. The seminar shall be conducted over a five-day (consecutive) period. Instruction time is defined as straight time working hours and does not include nights, weekends, or travel time to and from the project. Ownership has the right to video record the seminars.
- B. Submit seminar agenda, schedule and list of representatives to the Engineer for approval 30 days prior to suggested date of seminar. Do not commence seminar until the Engineer has issued a written acceptance of the starting time and attendees. Confirm attendance of seminar by written notification to participants.
- C. Instruct Owner's operating personnel in proper starting sequences, operation, shut-down, general maintenance and preventative maintenance procedures, including normal and emergency procedures.

- D. Submit final copies of Record Drawings and Operating and Maintenance Manuals to Owner at seminar.
- E. Submit a written record of minutes and attendees of the seminar to the Owner.

### 3.19 OPERATING AND MAINTENANCE MANUALS

- A. Provide Operating and Maintenance Manuals for equipment and materials furnished under this Division.
- B. Submit electronic copies of all operating and maintenance data books for review at least ten (10) weeks before the completion date. Assemble data in a completely indexed volume or volumes and identify the size, model, and features indicated for each item.
- C. Maintenance manuals shall include complete cleaning and servicing data compiled in a clear and easily understandable format. Show model numbers of each piece of equipment, complete lists of replacement parts, capacity ratings, and actual loads.
- D. Provide the following information where applicable:
  - 1. Identifying name and mark number
  - 2. Locations (where several similar items are used, provide a list)
  - 3. Complete nameplate data
  - 4. Certified Record Drawings and Final Reviewed submittals
  - 5. Parts list
  - 6. Performance curves and data
  - 7. Wiring diagrams
  - 8. Manufacturer's recommended operating and maintenance instructions with all non-applicable information deleted
  - 9. List of spare parts recommended for normal service requirements
  - 10. Assembly and disassembly instructions with exploded-view drawings where necessary
  - 11. Test reports
  - 12. Trouble shooting diagnostic instructions, where applicable
- E. After the Engineer's and Engineer's review, and any required Contractor revisions, submit a complete electronic copy, along with three (3) final hard copies of operating and maintenance data books for the following systems:
  - 1. Transformers
  - 2. Switchboards
  - 3. Panelboards
  - 4. Disconnect Switches
  - 5. Fire Management System

3.20 RECORD DRAWINGS

- A. The Contractor shall maintain, on a daily basis, at the Project site a complete set of Record Drawings. The Record Drawings shall initially consist of a set of black line plots or 3D BIM files of the Contractor's Coordination Drawings. The prints shall be marked or the 3D BIM files electronically updated to show the precise location of all buried or concealed work and equipment, including embedded conduit, raceways and boxes, and all changes and deviations in the Electrical work from that shown on the Contract Documents. This requirement shall not be construed as authorization for the Contractor to make changes in the layout or work without definite written instructions from the Engineer or Engineer. The updated Coordination Drawings shall be used to produce the final Record Drawings that shall be delivered to the Owner in electronic format media upon Project completion.
- B. The Contractor shall conduct monthly/quarterly walk-throughs of the project site with the Owner for verification of as-built conditions with the record drawings being maintained by the Contractor. Walk-throughs shall be scheduled by the Contractor prior to close-ins. Notify the Owner in writing at least three (3) days before walk-through.
- C. Record dimensions clearly and accurately to delineate the work as installed. Suitably identify locations of all equipment by at least two dimensions to permanent structures.
- D. The Contractor and Subcontractor shall mark all in-progress Record Drawings on the front lower right hand corner with a rubber stamp impression or an electronic image similar to the following:

RECORD DRAWING  
(3/8-inch high letters)

To be used for recording Field Deviations and  
Dimensional Data Only  
(5/16-inch high letters)

- E. Upon completion of the work, the Contractor and Subcontractor(s) shall certify all Record Drawings on the front lower right hand corner adjacent to the above marking with a rubber stamp impression or an electronic image similar to the following:

RECORD DRAWING  
CERTIFIED CORRECT  
(3/8-inch high letters)

(Printed Name of General Contractor)  
(5/16-inch high letters)

Date:

(Printed Name of Subcontractor)  
(5/16-inch high letters)

Date:

- F. Prior to final acceptance of the Work of this Division, the Contractor shall submit properly certified Record Drawings to the Engineer and Engineer for review and shall make

changes, corrections, or additions as the Engineer and/or Engineer may require to the Record Drawings. After the Engineer's and Engineer's review, and any required Contractor revisions, the Record Drawings shall be delivered to the Owner on electronic media in. Three (3) complete and bound hard copies shall be provided to the Owner. The Engineer and Engineer do not assume any responsibility for the accuracy or completeness of the Record Drawings.

### 3.21 FINAL PUNCHLIST

- A. Prior to the Final Punchlist, certify that systems and equipment are complete, operational, and are in compliance with the Contract Documents.
- B. During the Final Punchlist, provide personnel with access keys, hand held radios or other communication devices, and necessary expertise to operate each system and piece of equipment to demonstrate operational compliance with the Contract Documents.
- C. Any deficiencies noted on the Final Punchlist shall be expeditiously corrected and certified in writing.

### 3.22 EARLY OCCUPANCY

- A. Complete those systems which are necessary to allow partial early occupancy of the building.
- B. Verify and comply with requirements for temporary occupancy with the local Building and Fire Departments.

**END OF SECTION 26 05 01**

## SECTION 26 05 02

### EQUIPMENT CONNECTIONS AND COORDINATION

#### PART 1 – GENERAL

##### 1.1 DESCRIPTION

- A. Provide equipment connections and coordination in accordance with the Contract Documents.

##### 1.2 SUBMITTALS

- A. Fusible and non fusible safety switches
- B. Thermal over loads
- C. Variable frequency drives specified under Division 23
- D. Magnetic across the line starters

#### PART 2 – PRODUCTS

NOT APPLICABLE

#### PART 3 – EXECUTION

##### 3.1 GENERAL

- A. Provide equipment connections and coordination in accordance with manufacturer's recommendations and product submittals.
- B. Provide disconnect switches for equipment. Where equipment nameplate requires fuse protection, provide fusible type disconnect switches with fuses rated in accordance with equipment manufacturer's requirements. Circuit breakers rated HACR and recognized by the manufacturer of the equipment as suitable for fuse protection will suffice. Disconnect switches for single-phase equipment shall be thermal overload type. Locate disconnect switches in coordination with the layout of equipment. Provide supports for a free-standing installation if required to allow access to disconnect switch and/or proximity to equipment served.
- C. Provide final connections to hard-wired equipment with a minimum of two feet of flexible metal conduit or liquid-tight flexible metal conduit where required by code and in damp or wet locations.
- D. Where equipment is fed from overhead, support conduit on flanged floor type fitting.

##### 3.2 EQUIPMENT CONNECTION TYPES

- A. Provide equipment connection types as indicated on the equipment connection schedule.
- B. Equipment Connection Types:

1. Type DP: Duplex pump system with controller provided under Division 23. Provide connection to controller and connections from controller to pumps in accordance with the controller manufacturer's installation instructions. Provide connections for local controls and alarms in accordance with the controller manufacturer's installation instructions.
2. Type FR: Fractional horsepower single-phase motor. Provide thermal overload/disconnect switch and motor connection.
3. Type FWS: Equipment furnished with starter. Install starter and provide connection to starter and connection from starter to equipment.
4. Type M: Motor with starter provided under Division 26. Provide disconnect switch and motor connection.
5. Type SPC: Single point connection. Provide single point connection to equipment provided with factory-mounted starter/controller listed for single point power connection. Where required by code or the equipment manufacturer, provide fusible disconnect switch with fuses sized in accordance with equipment nameplate requirements.
6. Type VFD: Variable frequency drive furnished under Division 23. Install VFD and provide connection to VFD and connection from VFD to equipment.

### 3.3 MECHANICAL AND PLUMBING EQUIPMENT

- A. Provide electrical connections to mechanical, plumbing and fire protection equipment.
- B. Where motor controllers are furnished by others, provide connections at line side of controllers.
- C. Where reduced voltage, multiple speed, duplex, triplex, lead-lag, pony motor or other unusual controller types are utilized, coordinate specific requirements of motor(s) and controller and provide connections at line side of controllers.
- D. Provide branch circuits and connections for control power as required by controls contractor.
- E. Where electric unit heaters are provided with remote power panels, provide branch circuits between remote panel and duct heater elements in accordance with the equipment manufacturer's recommendations.
- F. Provide final connections between controller and equipment.
- G. Provide a separate light and graphics on the fire alarm graphic annunciator for each pre-action control panel.
- H. Provide audible, visual and combination audible visual devices in the protected area that are connected to the fire suppression pre-action control panel. Provide a laminated placard for each device identifying its connection to the pre-action system.

**END OF SECTION 26 05 02**

## SECTION 26 05 19

### 600V WIRE AND CABLE

#### PART 1 – GENERAL

##### 1.1 DESCRIPTION

- A. Provide 600V wire and cable in accordance with the Contract Documents.
- B. Related work specified in other divisions of these specifications.
  - 1. Raceways and Boxes

##### 1.2 REFERENCE STANDARDS

- A. Rubber Insulated Wire and Cable: ICEA S-19-81, NEMA WC 3, and UL 44.
- B. Thermoplastic Insulated Wire and Cable: ICEA S-61-402, NEMA WC 3, and UL 83.
- C. Cross-Linked Thermosetting Polyethylene Insulated Wire and Cable: ICEA S-66-524, NEMA WC 7, and UL 44.
- D. Service Entrance Cable: UL 854.
- E. Annealed Copper Wire for Conductors: ASTM B-3.
- F. Aluminum wire: AA8176 Prohibited
- G. Terminal Blocks: UL 1059.

##### 1.3 QUALITY ASSURANCE

- A. Wire and cable shall be of the same manufacturer.

##### 1.4 SUBMITTALS

- A. Provide a compliance / non-compliance specification attached to the front of the submittal. Identify each paragraph stating the submittal complies with the specification or does not comply. For every statement of non-compliance, include clear language as to the reason for the non-compliance and the submitted provisions that are intended to operate in its place.
- B. Field test reports.
- C. Building wire. Copper
- D. Metal Clad Cable.
- E. Armored Clad (AC) Cable. Prohibited.
- F. Underground Feeder (UF) cable. Prohibited.

- G. Non Metallic (NM) cable. Prohibited.

## 1.5 FIELD TESTING

- A. Inspect splices and terminations and make mechanically and electrically tight during the 15-day period immediately prior to final acceptance of the work.
- B. Feeder insulation shall be tested after installation, and before final connection.
  - 1. Tests shall be performed with a 500 volt megger, and conductors shall test free from short circuits and grounds.
  - 2. Conductors shall be tested phase-to-phase and phase-to-ground, phase-to-neutral.
  - 3. Furnish the instruments, materials, and labor required.
- C. Demonstration: Subsequent to wire and cable installation and connection, energize circuits and demonstrate functioning in accordance with contract requirements. Correct deficiencies and retest to demonstrate compliance.
- D. Record and document testing and submit to owner. Documentation shall include project name and address, testing agency name and address, testers name and employee number, feeder origin, destination, size, length, conduit size and material, anticipated testing result range and actual test results. In the event the feeder fails the test, include a corrective action and anticipated time line for completion. All feeders shall be tested and retested until all feeders pass and results are documented.

## PART 2 – PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Wire and Cable:
  - 1. Copper:
    - a. Southwire 600 Volts. Copper Conductor. Thermoplastic Insulation/Nylon Sheath, Heat, Moisture, Gasoline and Oil Resistant II. All sizes rated both THHN and either THWN (sizes 14, 12, and 10 AWG) or THWN-2 (sizes 8 AWG and larger and 14, 12, 10 AWG
    - b. 600 Volts & 1000 Volts Copper Conductor. Cross-Linked Polyethylene (XLPE) Insulation. High-Heat and Moisture Resistant.
    - c. Underground Service Entrance Cable. 600 Volt. Copper conductors. Cross-Linked Polyethylene (XLP) Insulation. High-Heat, Moisture, and Sunlight Resistant. RHH, RHW-2, USE-2.
    - d. SIMpull® THHN THWN-2 MTW / c(UL) T90 Nylon TWN75 Copper Conductor, 600V, Thermoplastic-Insulated Cable,
    - e. Alcan, Triangle, Anaconda, Brand-Rex, National, Okonite, Simplex meeting the specifications will be considered.
- B. Connectors:
  - 1. Wire size AWG number 12 through AWG number 6:

- a. Hand applied: Piggy (Thomas & Betts), Scotchlock (3M), or Wing Nut (Ideal).
  - b. Tool applied: Burndy HYDENT, or Thomas & Betts Stakon.
  - c. WAGO's 221 Series Splicing Lever Nuts Connectors connect solid, stranded and fine-stranded conductors ranging from 24–10 AWG.
2. Copper Wire size number 4 through number 1000 kcmil:
- a. IlSCO NIMBUS PBT INS BLK SPL / OFFSET: UL Listed and CSA Certified.
  - b. 600 volt at 90 Deg C.
  - c. Dual rated for copper and aluminum.
  - d. Removable port and screw plugs.
3. For feeder ampacity as rated.
- C. Electrical Tape:
- 1. Insulating type, Johns-Manville or 3M, UL Listed for the use.

## 2.2 WIRE AND CABLE

- A. General:
- 1. 600V minimum insulating rating.
- B. Conductor:
- 1. Electrical grade, annealed copper, tinned if rubber insulated, and fabricated in accordance with ASTM and ICEA standards. Minimum size number 12 for branch circuits; number 14 for control wiring. Switch legs are not considered control wiring.
- C. Stranding and Number of Conductors:
- 1. Number 12 and number 10 shall be solid.
  - 2. Larger than number 10, stranded ASTM Class B.
  - 3. Control wires stranded in accordance with ASTM Class B stranding designations.
  - 4. Cables for low-voltage systems shall be specified in other sections.
- D. Insulation:
- 1. 600 volts, PVC insulation, nylon jacket, surface-printed identification, listed as type THHN, THWN, THHW, THW-2, THWN-2, XHHW, XHHW-2 per UL 83.
- E. Color Coding:
- 1. Wiring shall be color coded as follows:

Conductor	120/208V System	277/480V System
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White	Gray
Ground	Green	Green

Conductor	120/208V System	277/480V System
Isolated Ground	Green/Yellow Stripe	

2. Wire number 8 and smaller shall be factory-color coded the entire length. Wire number 6 and larger shall be color coded by color taping entire length of exposed conductor at all accessible locations or factory-color coded where available.
3. Control wiring shall be color coded in accordance with manufacturer's recommendations and as elsewhere specified

### 2.3 MC FEEDER CABLE – COPPER CONDUCTORS

- A. Prohibited

### 2.4 SERVICE ENTRANCE CABLE SE TYPE R

- A. Prohibited

### 2.5 NM-B COPPER CONDUCTOR-600V

- A. Prohibited

### 2.6 Shielded variable frequency drive cable:

- A. Shielded conductor and signal cable with symmetric bare grounds and overall shield to block emi and rfi interference.
- B. Conductor Material: stranded tinned copper
- C. Shield: Foil tape and tinned copper braid shield
- D. Comply with 2000V UL 1277 Type TC-ER per 2005 NEC Article 336
- E. Rated for 90°C wet/dry
- F. Suitable for Class I & II; Division 2 hazardous location
- G. Comply with UL 1685 vertical tray flame test
- H. Comply with IEEE 1202 vertical tray flame test at 70,000 BTU/hour
- I. Comply with CSA FT4
- J. Comply with Oil & Sunlight resistant
- K. RoHS compliant and CE approved.

### 2.7

## **PART 3 – EXECUTION**

### 1.1 GENERAL

#### 600V WIRE AND CABLE

- A. Maximum of three branch circuits in one conduit unless otherwise indicated.
- B. Do not install wire until raceway systems are complete.
- C. Provide cable supports for vertical risers as required by all applicable codes
- D. Wire size shall be uniform for the entire length of the circuit unless noted otherwise.
- E. Do not splice feeders or dedicated branch circuits unless otherwise indicated.
- F. Make connections, splices, taps, and joints with solderless devices, mechanically and electrically secure.
- G. Lubricate cables to facilitate pulling as required by cable manufacturer. Lubrication material shall be inert to cable insulation and raceways.
- H. Where compression connectors are used, provide connectors with hydraulic die, embossing die code into connector. Connect to bus with Bellville type washers for positive pressure over complete contact area. Insulate with heat shrink tubing.
- I. Provide a separate neutral for ground fault interrupter branch circuits.
- J. Exposed feeders and branch circuits shall be electric metal tubing.

#### 1.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Exposed Feeders: Type THHN-THWN, THW-2, THWN-2, XHHW-2 single conductors in raceway.
- B. Exposed Branch Circuits: Type THHN-THWN, THW-2, THWN-2, XHHW, XHHW-2 single conductors in raceway.

#### 1.4 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal raceways and cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Exposed raceways and cables permitted in utility rooms.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

#### 1.5 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 and UL 486B.

- B. Make splices 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 (150 mm) of slack conductor extending past the front of the box.

1.6 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

**END OF SECTION 26 05 19**

## SECTION 26 05 26

### GROUNDING SYSTEM

#### PART 1 – GENERAL

##### 1.1 DESCRIPTION

- A. Provide electrical grounding systems in accordance with the Contract Documents and as specified herein.

##### 1.2 REFERENCE STANDARDS

- A. UL 467.
- B. ANSI C-1.
- C. IEEE 142.
- D. NEC.
- E. National Electrical Safety Code.
- F. All equipment and material to be furnished and installed on this project shall be UL listed, in accordance with the requirements of the authorities having jurisdiction, and suitable for its intended use on this project.

##### 1.3 SUBMITTALS

- A. Field test report.
- B. Provide a compliance / non-compliance specification attached to the front of the submittal. Identify each paragraph stating the submittal complies with the specification or does not comply. For every statement of non-compliance, include clear language as to the reason for the non-compliance and the submitted provisions that are intended to operate in its place.

##### 1.4 FIELD TESTING

- A. Resistance testing of ground rod system indicating maximum 5 ohms resistance to ground.

##### 1.5 IDENTIFICATION

- A. Label each end of each grounding electrode conductor, identifying the connection point of the opposite end of the conductor.

#### PART 2 – PRODUCTS

##### 2.1 GENERAL

- A. Grounding connections shall be brazed, molded exothermic welded, bolted clamp terminal bars, or listed pressure connector type.

- B. All equipment and materials provided under this section of the Specifications shall be new, UL listed and bear the UL label.
- C. All disconnects shall be provided with a copper equipment ground bar bolted, brazed or riveted to the associated enclosure or cabinet. Refer to each individual equipment Specification section for additional grounding requirements.
- D. All receptacles, switches, disconnects and devices shall be provided with a grounding terminal connected to the device frame and the enclosure. Refer to each individual equipment Specification section for additional grounding requirements.
- E. All conduit, raceways, junction boxes, pull boxes, etc., shall be made electrically continuous by means of grounding conductors, bonding jumpers, grounding bushings, etc., as required by the NEC and the authorities having jurisdiction.

### **PART 3 – EXECUTION**

#### **3.1 GENERAL**

- A. Metallic raceways, enclosures, equipment frames, fittings, and other metallic noncurrent-carrying equipment parts and surfaces shall be effectively bonded to the grounding system. Nonconductive paint, enamel, or similar coating shall be removed at threads and contact surfaces to preserve grounding continuity or fittings shall be provided to make such removal unnecessary.
- B. Neutral wiring shall be grounded at the system point of origin only and shall be isolated from downstream grounding systems.
- C. Provide an insulated grounding conductor for all segments of branch circuits.
- D. Receptacles shall be grounded to the outlet box by means of a bonding jumper between the outlet box and the receptacle grounding terminal.
- E. Branch circuits shall be provided with an insulated grounding conductor run with the circuit conductors. This grounding conductor shall be in addition to the ground path provided by the continuously grounded metallic raceway system that encloses the phase and neutral conductors.
- F. Provide bolted clamp terminal connectors where connected to removable equipment.

**END OF SECTION 26 05 26**

## SECTION 26 05 33

### RACEWAYS AND BOXES

#### PART 1 – GENERAL

##### 1.1 DESCRIPTION

- A. Provide a compliance / non-compliance specification attached to the front of the submittal. Identify each paragraph stating the submittal complies with the specification or does not comply. For every statement of non-compliance, include clear language as to the reason for the non-compliance and the submitted provisions that are intended to operate in its place.
- B. Provide raceways and boxes in accordance with the Contract Documents.

##### 1.2 SUBMITTALS

- A. Conduit, Boxes:
- B. Manufacturer's product data sheets, volume dimensions, physical dimensions, Listing agencies, and weights.

##### 1.3 IDENTIFICATION

- A. Mark junction box covers with permanent stencil identification of panelboard and circuit numbers of wiring contained within.
- B. Paint fire alarm raceways and red. Pre-painted raceways will be acceptable.

#### PART 2 – PRODUCTS

##### 2.1 ACCEPTABLE MANUFACTURERS

- A. Conduit and Boxes:
  - 1. UL Listed and labeled products of any manufacturer meeting the specified performance requirements are acceptable.
- B. Wireways and Auxiliary Gutters:
  - 1. Siemens, Square D, or equal.
  - 2. Wireways and auxiliary gutters shall be UL Listed and labeled.

##### 2.2 CONDUIT AND FITTINGS

- A. Rigid Steel Conduit:
  - 1. Rigid conduit, heavy wall, hot-dipped galvanized inside and out, threaded ends.
  - 2. Threaded type fittings.
  - 3. Schedule 40
- B. Electrical Metallic Tubing:

1. Continuous, seamless steel tubing galvanized or sherardized on exterior, coated on interior with smooth hard finish of lacquer, varnish or enamel.
2. Steel, set screw or compression fittings. Cast connectors and coupling are prohibited.
3. Provide concrete type fittings where required.
4. Conduits shall be color coded and identified as required by code or the local authority having jurisdiction and as specified herein.
5. Conforming to NEC Article 358

C. Flexible Metal Conduit:

1. Single strip, continuous, flexible interlocked double-wrapped steel, hot-dip galvanized inside and out forming smooth internal wiring channel.
2. Steel, compression type fittings.
3. Conforming to NEC Article 348.

D. Liquid Tight Flexible Conduit:

1. Same as flexible metal conduit except with tough, inert, watertight plastic outer jacket.
2. Fittings shall be cast malleable iron body and gland nut, zinc-plated with one-piece brass grounding bushings threaded to interior of conduit. Spiral molded vinyl sealing ring between gland nut and bushing and nylon-insulated throat.
3. Conforming to NEC Article 350.

E. Flexible non-metallic conduit

1. Prohibited

F. Electric Non Metallic Tubing

1. Prohibited

## 2.3 WIREWAYS AND AUXILIARY GUTTERS

- A. Sizes and shapes as indicated and/or as required.
- B. Provide necessary elbows, tees, connectors, adapters, etc.
- C. Continuous removable cover secured with screws and keyhole slots. Hinged cover where installed above suspended ceiling.
- D. Provide wire retainers at not greater than 12 inches on center.

## 2.4 OUTLET, JUNCTION, AND PULL BOXES

A. Cast Type Boxes:

1. Ferrous alloy box with inside threaded hubs for rigid steel conduit.
2. Ferrous alloy box with compression or inside threaded hubs with adapter for electrical metallic tubing.
3. Cast raised cover, size matched to contour of box.
4. Tapered threads for hubs.

B. Galvanized Pressed Steel Type Boxes:

1. General:
  - a. Pressed steel, galvanized or cadmium-plated, 4 inches minimum octagonal or square with galvanized cover or extension ring as required.
- C. Sheet Steel Boxes:
  1. No. 12 gauge sheet steel for boxes with maximum side less than 40 inches, and maximum area not exceeding 1,000 square inches; riveted or welded 3/4-inch flanges at exterior corners.
  2. No. 10 gauge sheet steel for boxes with maximum side 40 to 60 inches, and maximum area 1,000 to 1,500 square inches; riveted or welded 3/4-inch flanges at exterior corners.
  3. No. 10 gauge sheet steel riveted or welded to 1.5 inch by 1.5 inch by 1/4-inch welded angle iron framework for boxes with maximum side exceeding 60 inches and more than 1,500 square inches in area.
  4. Covers:
    - a. Same gauge steel as box.
    - b. Subdivided single covers so no section of cover exceeds 50 pounds.
    - c. Machine bolts or machine screws threaded into tapped holes.
  5. Paint:
    - a. Rust inhibiting primer, ANSI 61 grey enamel finish coat.

## **PART 3 – EXECUTION**

### **3.1 GENERAL**

- A. 277/480V or 265/460V wiring shall be kept independent of 120/208V wiring. Emergency system wiring shall be kept independent of other wiring systems. Provide insulated grounding conductor in all feeder and branch circuit raceways. Minimum conduit size shall be 3/4-inch, including conduit for low-voltage cabling. Wiring of each type and system shall be installed in separate raceways.
- B. Protect metallic raceway in earth or fill from corrosion with two coats of corrosion-resistant paint or tape wrap.
- C. Locate raceways so that the integrity of structural members is not affected, and they do not conflict with the services of other trades. Draw up couplings and fittings full and tight. Protect threads from corrosion after installation with zinc chromate or equivalent protection.
- D. Conceal raceways except at surface-mounted cabinets and freestanding equipment. Install minimum of 6 inches from flues, steam pipes, or other heated lines. Route exposed raceways parallel or perpendicular to building lines with right-angle turns and symmetrical bends. Provide sleeves in concrete walls, floor slabs and partitions. Waterproof sleeved raceways where required.
- E. Provide raceway expansion joints for exposed and concealed raceways at expansion joints and between structures to compensate for differential movement. Provide bonding conductor.

- F. Clear raceway of all obstructions and dirt prior to pulling in wires or cables. Use ball mandrel (diameter approximately 85 percent of conduit insides diameter) followed by close-fitting wire brush and wad of felt or similar material. This assembly may be pulled with, but ahead of cable being installed. Clean empty raceways similarly. Clear or replace any raceway which rejects ball mandrel.
- G. Secure raceways clamps or supports to masonry materials with toggle bolts, expansion bolts, or steel inserts. Install raceway on steel construction with approved clamps which do not depend on friction or set-screw pressure alone.
- H. Provide independent support of raceways larger than 3/4 inch. Provide uni-strut support and threaded rod to structure above for multiple suspended raceways run together. Use of lathe channels or other miscellaneous steel to support raceways is not permitted. Use listed supports such as uni-strut or similar systems for support.

### 3.2 WIREWAYS AND AUXILIARY GUTTERS

- A. Install wireways such that cover will hinge upward from side.

### 3.3 OUTLET, JUNCTION, AND PULL BOXES

- A. Provide outlet, junction, and pull boxes as indicated and as required for a complete installation and to facilitate proper pulling of wires and cables. Boxes shall be sized per National Electrical Code as minimum. Plug open knock outs.
- B. The exact location of outlets and equipment is governed by field conditions. Where necessary, relocate outlets so that fixtures and equipment are symmetrically located in accordance with the room layout and will not interfere with other work or equipment. Verify final location of outlets, fixtures, and equipment with engineer.
- C. Provide pull boxes so that an individual run of conduit does not contain more than the equivalent of four 90-degree bends (360 degrees total).
- D. Where boxes are installed outside exposed to the elements, weatherproof in-use covers shall be provided.

### 3.4 APPLICATION OF RACEWAYS

- A. Electrical Metallic Tubing:
  - 1. General purpose feeders and branch circuits rated greater than 100A, except where another conduit type is specifically required.
  - 2. Exposed indoor installations in branch electrical closets and telecommunications rooms below ten feet above finished floor.
- B. Metal Clad Cable:
  - 1. Prohibited
- C. Flexible Metal Conduit:
  - 1. Dry locations only.
  - 2. Connections to equipment where vibration isolation is needed.
  - 3. Maximum length shall be six feet.

D. Liquid-Tight Flexible Steel Conduit:

1. Same as Flexible Metal Conduit in damp or wet locations.
2. Motor connections.

E. Liquid-Tight Flexible Non-metallic Conduit:

1. Prohibited.

F. Rigid Polyvinyl Conduit:

1. Prohibited

G. Electric Non Metallic Tubing

1. Prohibited

H. Wireways and Auxiliary Gutters:

1. Where indicated.
2. Above and below panelboards, lighting relay cabinets, fire alarm panels, and terminal cabinets to accommodate large concentrations of wires.

3.5 APPLICATION OF BOXES OUTLET, JUNCTION AND PULL BOXES

A. Galvanized Pressed Steel Type Boxes:

1. Where connected to electrical metallic tubing and flexible steel conduit, 1.25 inches and smaller.
2. Dry locations.
3. Where concealed in walls and above suspended ceilings.

B. Sheet Steel Boxes:

1. Where connected to conduit larger than 1.25 inches.

**END OF SECTION 26 05 33**

## SECTION 26 27 26

### WIRING DEVICES

#### PART 1 – GENERAL

##### 1.1 DESCRIPTION

- A. Provide wiring devices in accordance with the Contract Documents.

##### 1.2 QUALITY ASSURANCE

- A. Switches, receptacles and wall plates shall be of the same manufacturer.
- B. Equipment shall be certified for use in the District of Columbia and shall meet the Local Energy Code and local energy ordinances.

##### 1.3 REFERENCE STANDARDS

- A. Switches: Federal Specification WS-896E.
- B. Receptacles: Federal Specification WC-596D, NEMA WD-1, and UL 498.
- C. Ground Fault Circuit Interrupter Receptacles: UL 943 Class A.
- D. Arc Fault Circuit Interrupter Receptacles: UL 1699
- E. Wall Dimmers: ANSI C62.41, UL 20.

##### 1.4 SUBMITTALS

- A. Wiring Devices complete with physical dimensions, materials, connector details, voltage and current ratings, installation details, etc.
- B. Samples of each receptacle, switch, wall plate and cover plate intended for use on this Project. All device samples must be reviewed by and approved by the Architect and Owner prior to ordering.
- C. Provide a compliance / non-compliance specification attached to the front of the submittal. Identify each paragraph stating the submittal complies with the specification or does not comply. For every statement of non-compliance, include clear language as to the reason for the non-compliance and the submitted provisions that are intended to operate in its place.

##### 1.5 COLORS

- A. Device and coverplate colors shall ivory. Catalog numbers, where included in this Specification, are not to be used to determine colors of devices and coverplates.
- B. Coordinate device color with all coverplate colors and shall match.

## PART 2 – PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Catalog numbers shall not be used to determine colors of devices and cover plates. Catalog numbers are used to establish minimum acceptable standard.
- B. Switches and Receptacles: Leviton, Cooper, Hubbell, or Legrand Pass & Seymour.

### 2.2 SWITCHES

- A. General:
  - 1. Switches shall be of the type indicated on the Drawings.
  - 2. Switches shall be commercial specification grade, 20A, 120/277V, 1HP rated at 120V, 2HP rated at 240V, back- and side-wired, silent handle operation.
  - 3. Pre-terminated plug style switches and sensors are permitted.
- B. Weatherproof Switches:
  - 1. Weatherproof handle/coverplate.

### 2.3 RECEPTACLES

- A. General:
  - 1. GFCI receptacles shall be installed per NEC 2020 210.8
  - 2. AFCI receptacles shall be installed per NEC 2020 210.12
  - 3. Receptacles shall be of the type indicated on the Drawings.
  - 4. Receptacles shall be 20A, commercial specification grade, 125V, grounding type, back- and side-wired. Residential grade receptacles are acceptable within dwelling units.
  - 5. Receptacles shall have a single piece, heavy duty brass ground contact and mounting strap.
  - 6. Receptacles shall have a nylon face and heat resistant base.
  - 7. Pre-terminated plug style receptacles are permitted.
- B. Special Purpose Receptacles: Rating as indicated on the Drawings.
- C. Weatherproof Receptacles:
  - 1. Duplex, weatherproof while-in-use rated coverplate with hinged door.
  - 2. All 15- and 20-ampere, 125- and 250-volt non-locking receptacles located in damp or wet locations shall be a listed weather-resistant type. Listed devices shall bear a "WR" marking on the face that is visible when installed.

### 2.4 COVER PLATES

- A. Provide cover plates for wiring devices. Provide multiple gang cover plates where multiple devices are installed in a common location. Coordinate gang's with architectural and interiors elevations and details.
- B. Provide polished stainless steel, smooth-face cover plates in equipment rooms. Thermoset coverplates are not acceptable.

- C. Labeling: Receptacles located in the following rooms shall be labeled with panel and circuit number feeding the device:

- 1. Utility Rooms

### **PART 3 – EXECUTION**

#### **3.1 GENERAL**

##### **A. General:**

- 1. Verify the exact location of wiring devices with Architect.
- 2. Provide a number 12 grounding conductor from the device grounding terminal to the panelboard ground bus. Bond wiring device to the outlet box.
- 3. Provide a number 12 grounding conductor from the device grounding terminal to the outlet box.
- 4. Receptacles mounted in boxes shall be installed so that the mounting yoke or strap of the receptacle is held rigidly against the surface of the wall.
- 5. Receptacle faces shall project a minimum of 0.015 inches [0.4 millimeters] from the faceplate. Faceplates shall be installed so as to completely cover the opening and seat against the mounting surface.

##### **B. Switches:**

- 1. Mount switches vertically with the ON position on top.
- 2. Mount switches on the strike side of doors.
- 3. Provide toggle handle type lighting switches in equipment rooms. Provide rocker handle type lighting switches in other areas.

##### **C. Receptacles:**

- 1. Mount receptacles vertically with the grounding pin down.
- 2. Provide conventional style duplex receptacles in equipment rooms
- 3. Receptacles shall be mounted 15" to the bottom of the box for general convenience receptacles.

**END OF SECTION 26 27 26**

## SECTION 26 28 16

### DISCONNECT SWITCHES AND INDIVIDUAL MOTOR CONTROLLERS

#### PART 1 – GENERAL

##### 1.1 DESCRIPTION

- A. Provide disconnect switches and individual motor controllers in accordance with the Contract Documents.

##### 1.2 QUALITY ASSURANCE

- A. Disconnects shall be of the same manufacturer.

##### 1.3 REFERENCE STANDARDS

- A. Disconnect Switches:
  - 1. Federal Specification W-S-865C
  - 2. NEMA KS1
  - 3. UL 98 (File #4776) and 508
- B. Individual Motor Controllers:
  - 1. NEMA ICS 2-321
  - 2. UL 547, 845 and 1004

##### 1.4 SUBMITTALS

- A. All disconnect ratings and voltages.
- B. Provide a compliance / non-compliance specification attached to the front of the submittal. Identify each paragraph stating the submittal complies with the specification or does not comply. For every statement of non-compliance, include clear language as to the reason for the non-compliance and the submitted provisions that are intended to operate in its place.
- C. Submittal shall include highlighted equipment specific for the project. Irrelevant information not pertaining to the project shall be stricken accordingly.

##### 1.5 FIELD TESTING

- A. Test each individual motor controller circuit and verify proper operation.

##### 1.6 IDENTIFICATION

- A. Provide an identification nameplate for each disconnect switch and individual motor controller.

## **PART 2 – PRODUCTS**

### **2.1 ACCEPTABLE MANUFACTURERS**

- A. Siemens, Square D, Cutler Hammer (Eaton), or General Electric (ABB).

### **2.2 DISCONNECT SWITCHES**

- A. Heavy duty for 800A or less, horsepower rated, quick-make, quick-break, dead-front type. Self-contained unit in a NEMA 1 enclosure (NEMA 3R, gasketed where installed outdoors or where exposed to water spray, dust or dirt), externally operable from the front.
- B. Defeatable interlock to prevent opening the door when the switch is in the ON position. Handle shall be capable of being padlocked in the OFF position.
- C. Fusible switches shall be equipped with rejecting type clips suitable for UL Class R fuses up to 600A, suitable for UL Class L fuses above 600A. Interrupting rating shall be 200,000 RMS-symmetrical amperes.
- D. Voltage, ampacity, horsepower rating, and number of poles shall be appropriate for system and load served. Provide neutral pad for circuits with neutral conductors. Provide ground lug.

## **PART 3 – EXECUTION**

### **3.1 GENERAL**

- A. Disconnect switches and individual motor controller shall be installed within ten feet of load served and installed within sight of the motor.
- B. Provide independent support; do not mount on the housing of the equipment served.
- C. Conduit connected between disconnect switch or individual motor controller and load served shall be flexible metal conduit where used indoors and liquid-tight flexible metal conduit where used outdoors or connected to a NEMA 3R rated device, 24 inches minimum length, 36 inches maximum length.

**END OF SECTION 26 28 16**

**SECTION 26 00 00**

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**END OF SECTION 26 00 00**

BLACK TEXT ALL JURISDICTIONS

## SECTION 26 05 01

### ELECTRICAL GENERAL PROVISIONS

#### PART 1 – GENERAL

##### 1.1 DESCRIPTION

- A. The General and Supplementary Conditions and other Divisions are a part of the requirements for the work under this Division of the Specifications.
- B. It is the intent of these Specifications to provide complete systems. Completeness shall mean that all materials, equipment, and systems as installed and operating on this project have been installed properly with the best practices of the trade; are suitable for the intended purpose, location, and environment; properly fit within the physical space limitations for the project; are in conformance with applicable codes and reference standards; have been started-up, tested, adjusted, and commissioned for the intended use; have maintained applicable UL Listings; are in compliance with manufacturer's recommendations and warranty requirements; ready for the Owner's use, and in the opinion of the engineer, performing as designed.

##### 1.2 WORK INCLUDED

- A. Provide labor and materials required to install, test and place into operation the electrical systems as called for in the Contract Documents, in accordance with applicable codes and regulations and in accordance with the equipment manufacturers written directions.
- B. Provide labor, materials, and accessories required to provide complete, operating electrical systems. Labor, materials, or accessories not specifically called for in the Contract Documents, but required to provide complete, operating electrical systems shall be provided without additional cost.

##### 1.3 QUALITY ASSURANCE

- A. Comply with the current applicable codes, ordinances, and regulations of the Authority or Authorities Having Jurisdiction, the rules, regulations, and requirements of the utility companies serving the project, and the Owner's insurance underwriter.
- B. Drawings, specifications, codes and standards are minimum installation requirements. Where requirements differ, the most stringent apply.
- C. Should any change in drawings or specifications be required to comply with governing regulations, notify the Engineer prior to submitting bid.
- D. All electrical equipment, materials, devices, and installations shall meet or exceed minimum requirements of ADA, ANSI, ASTM, IEEE, IES, NEC, NEMA, NETA, NFPA, OSHA, SMACNA and UL.
- E. Execute work in strict accordance with the best practices of the trades in a thorough, substantial, workperson-like manner by competent workpeople. Provide a competent, experienced, full-time Superintendent who is authorized to make decisions on behalf of the Contractor.

- F. Equipment shall be certified for use in the District of Columbia and shall meet the local energy code.

#### 1.4 ABBREVIATIONS AND DEFINITIONS

##### A. Abbreviations:

1.	ADA	Americans with Disabilities Act
2.	ANSI	American National Standards Institute
3.	ASA	Acoustical Society of America
4.	ASTM	American Society for Testing and Materials
5.	BIL	Basic Impulse Level
6.	CBM	Certified Ballast Manufacturers
7.	ECC	Engineer's Control Center
8.	EIA	Electronic Industries Alliance
9.	ETL	Electrical Testing Laboratories, Inc.
10.	FCC	Fire Control Center
11.	FM	Factory Mutual
12.	IEEE	Institute of Electrical and Electronic Engineers
13.	IES	Illuminating Engineering Society
14.	IPCEA	International Power Cable Engineers Association
15.	LED	Light Emitting Diode
16.	NEC	National Electrical Code
17.	NEMA	National Electrical Manufacturers Association
18.	NETA	National Electrical Testing Association
19.	NFPA	National Fire Protection Association
20.	OEM	Original Equipment Manufacturer
21.	OSHA	Occupational Safety and Health Administration
22.	SCC	Security Control Center
23.	SMACNA	Sheet Metal and Air Conditioning Contractors National Association
24.	TIA	Telecommunications Industry Association
25.	UL	Underwriters Laboratories Inc.

##### B. Definitions:

1. Where it is stated in these specifications to submit to the Engineer for review, refer to General and Supplementary Conditions for proper procedures.
2. FURNISH means to supply all materials, labor, equipment, testing apparatus, controls, tests, accessories, and all other items customarily required for the proper and complete application.
3. INSTALL means to join, unite, fasten, link, attach, set up or otherwise connect together before testing and turning over to Owner, complete and ready for regular operation.
4. PROVIDE means to FURNISH and INSTALL.
5. AS DIRECTED means as directed by the Engineer, or the Engineer's Representative.
6. CONCEALED means embedded in masonry or other construction, installed behind wall furring or within drywall partitions, or installed above suspended ceilings.
7. SUBMIT means submit to Engineer for review.

#### 1.5 GUARANTEE

- A. Submit a single guarantee stating that the work is in accordance with the Contract Documents. Guarantee work against faulty and improper material and workmanship for a

period of one year from the date of final acceptance by the Owner, except that where guarantees or warranties for longer terms are provided or specified herein, the longer term shall apply. Correct any deficiencies, which occur during the guarantee period, within 24 hours of notification, without additional cost. Obtain similar guarantees from subcontractors, manufacturers, suppliers and sub-trade specialists.

#### 1.6 USE OF THE ENGINEER'S AND ENGINEER'S DRAWINGS

- A. The Contractor shall obtain from the Engineer a set of 3D BIM or compatible format engineering drawings on electronic media where desired by the Contractor and/or required by the Specifications for use in preparing the shop drawings, coordination drawings, and record drawings. The Contractor shall provide to the Engineer a written or electronic release of liability acceptable to the Engineer prior to receiving the electronic media.

### **PART 2 – PRODUCTS**

#### 2.1 EQUIPMENT AND MATERIALS

- A. Provide products and materials that are new, clean, free of defects, and free of damage and corrosion.
- B. Products and materials shall not contain lead, asbestos, PCB, or any other material that is considered hazardous by the Environmental Protection Agency or any other Authority Having Jurisdiction.
- C. Replace materials of less than specified quality and relocate work incorrectly installed as directed by the Engineer at no additional cost.
- D. Provide name / data plates on major components of equipment with manufacturer's name, model number, serial number, capacity data and electrical characteristics attached in a conspicuous place.
- E. Install materials and equipment with qualified trades people.
- F. Maintain uniformity of manufacturer for equipment used in similar applications and sizes.
- G. Fully lubricate equipment where required.
- H. Follow manufacturer's instructions for installing, connecting, and adjusting equipment. Provide a copy of such instructions at the equipment during installation.
- I. Where factory testing of equipment is required to ascertain performance, and attendance by the Owner's Representative is required to witness such tests, associated travel costs and subsistence shall be paid for by the Contractor.
- J. Equipment capacities, ratings, etc., are scheduled or specified for job site operating conditions. Equipment sensitive to altitude shall be derated with the method of derating identified on the submittals.
- K. Enclosures for electrical equipment installed indoors in mechanical or electrical equipment rooms shall be NEMA type 1. Enclosures for electrical equipment installed outdoors shall be NEMA type 3R – gasketed or as specified on the drawings.

- L. Energy consuming equipment shall be certified for use in the District of Columbia and shall meet the local energy code and local energy ordinances.

## 2.2 SUBSTITUTIONS

- A. Contract Documents are based on equipment manufacturers as called out in the Specifications and indicated on the Drawings. Contract documents include a basis of design in which the design is centered. Other manufacturers listed in the specification are acceptable if the equipment fits in the designated area without altering the engineering design and meets other clauses in the specifications. Acceptance of substitute equipment manufacturers does not relieve Contractor of the responsibility to provide equipment and materials, which meet the performance as, stated or implied in the Contract Documents.
- B. Submit proposals for review and approval, to provide substitute materials or equipment, in writing, fifteen business days prior to submission of bid. Substituted materials or equipment received after that time will not be acceptable or reviewed. Reimburse Owner for costs associated with the review of the proposed substitution whether substitution is accepted or rejected.
- C. Indicate revisions required to adapt substitutions including revisions by other trades. Substitutions that increase the cost of the work and related trades are not permitted or shall be paid for by the contractor.
- D. The proposed substitution shall conform to the size, ratings, and operating characteristics of the equipment or systems as specified and shown on the Drawings. The substitution must fit into available space conditions and must function properly in coordination with the rest of the system.
- E. Proposals for substitutions shall include the following information:
  - 1. A description of the difference between the Contract Document requirements and that of the substitution, the comparative features of each, and the effect of the change on the end result performance. Include the impact of all changes on other contractors and acknowledge the inclusion of additional costs to the other trades.
  - 2. Schematic drawings and details.
  - 3. List of revisions to the Contract Documents that must be made if the substitution is accepted.
  - 4. Estimate of added or reduced costs the Contractor may incur in implementing the substitution, such as test, evaluation, operating and support costs.
  - 5. Statement of the time by which a Contract modification accepting the substitution must be issued, noting any effect on the Contract completion time or the delivery schedule.
  - 6. A statement indicating the reduction to the Contract price if the Owner accepts the substitution. Include required modifications to all related trades.

## PART 3 – EXECUTION

### 3.1 FEES AND PERMITS

- A. Pay all required fees and obtain all required permits related to the electrical installation.
- B. Pay royalties or fees in connection with the use of patented devices and systems.

- C. Provide controlled inspection where required by Authorities Having Jurisdiction or by these specifications.

### 3.2 SUBMITTALS AND REVIEWS

- A. Submit shop drawings, manufacturer's product data sheets, samples, and test reports as specified.
- B. Submit a complete typed list of all electrical equipment manufacturers and material suppliers for the equipment proposed to be provided on this project, as well as names of all subcontractors.
- C. Prepare an index of all submittals for the project. Include a submittal identification number, a cross-reference to the Specification sections or Drawing number, and an item description. Prefix the submittal identification number by the Specification sections to which they apply. Indicate on each submittal, the submittal identification number in addition to the other data specified. All subcontractors shall utilize the assigned submittal identification number.
- D. After the Contract is awarded, obtain complete shop drawings, product data and samples from the manufacturers, suppliers, vendors, and all subcontractors, for all materials and equipment as specified. Submit data and details of such materials and equipment for review. Prior to submission, certify that the shop drawings, product data and samples are in compliance with the Contract Documents. Include as part of the Shop Drawing the specification section. Provide a compliance / non-compliance specification attached to the front of every submittal. Identify each paragraph stating the submittal complies with the specification or does not comply. For every statement of non-compliance, include clear language as to the reason for the non-compliance and the submitted provisions that are intended to operate in its place. Submittals without the required compliance / non-compliance specification attached will not be reviewed and will be returned "Review and Resubmit". Check all materials and equipment upon their arrival on the job site and verify their compliance with the Contract Documents. Modify any work, which proceeds prior to receiving accepted shop drawings as required to comply with the Contract Documents and the shop drawings.
- E. Non applicable items in the specifications shall be clearly stricken out. Applicable items shall be clearly highlighted. Submittals lacking the clarity of stricken or highlighted information shall be returned marked Revise and Resubmit.
- F. Review of submittals is for general compliance with the design concept and Contract Documents. Comments or absence of comments shall not relieve the Contractor from compliance with the Contract Documents. The Contractor remains solely responsible for details and accuracy, for confirming and correlating all quantities and dimensions, for selecting fabrication processes, for techniques of construction, for performing the work in a safe manner, and for coordinating the work with that of other trades.
- G. No part of the work shall be started in the shop or in the field until the shop drawings and samples for that portion of the work have been submitted reviewed, and returned with either "No Exceptions Noted" or "Exceptions Noted" marked on the submission.
- H. A minimum period of ten working days, exclusive of transmittal time, will be required in the Engineer's office each time a shop drawing, product data and/or samples are submitted for review. This period must be considered by the Contractor in the scheduling of the work.

- I. Submit electronic submittals of the shop drawing or product data as PDF electronic files in compliance with the Division 1 requirements. All electronic submittals shall include the associated cover sheet and submittal number. Submit all material samples with the appropriate cover sheet and sample number.
- J. Submissions will be stamped as follows:

Stamp		Interpretation
<input type="checkbox"/>	No Exceptions Noted	Fabrication, manufacture, or construction may proceed providing submittal complies with the Contract Documents.
<input type="checkbox"/>	Exceptions Noted: Resubmit for Record	Fabrication, manufacture, or construction may proceed providing submittal complies with both the Contract Documents and the Engineer's notations. Resubmit revised submittal for record only.
<input type="checkbox"/>	Exceptions Noted: No Resubmission Required	Fabrication, manufacture, or construction may proceed providing submittal complies with both the Contract Documents and the Engineer's notations.
<input type="checkbox"/>	Revise and Resubmit	Submittal does not comply with the Contract Documents. Do not proceed with fabrication, manufacture, or construction. The work and/or shop drawings are not permitted at the job site.
<input type="checkbox"/>	For Review Only	Informational Submittal: Submittal does not require the Engineer's responsive action.

- K. Submit materials and equipment by manufacturer, trade name, and model number. Include copies of applicable brochure or catalog material. Maintenance and operating manuals are not acceptable substitutes for shop drawings.
- L. Identify each sheet of printed submittal pages (using arrows, highlighting, underlining or circling) to show applicable sizes, types, model numbers, ratings, capacities and options actually being proposed. Cross out non-applicable information. Note specified features such as materials or paint finishes. Cross out all references to "options". Cross out statements such as "subject to change without notice" or "not for construction". Anything not specifically excluded is assumed to be included. Submittals that do not clearly indicate excluded information will not be reviewed and will be returned marked "Revise and Resubmit".
- M. Include dimensional data for roughing in and installation and technical data sufficient to verify that equipment meets the requirements of the Contract Documents. Include wiring, conduit routing and service connection data.
- N. Maintain a complete set of reviewed and stamped shop drawings and product data on site.
- O. For each room or area of the building containing electrical equipment, submit the following:
  - 1. Floor Plans: Plan and elevation layout drawings indicating the equipment in the exact location in which it is intended to be installed. These plans shall be of a scale not less than 1/4 inch to 1 foot. They shall be prepared in the following manner:

- a. Indicate the physical boundaries of the space including door swings and ceiling heights and ceiling types (as applicable).
  - b. Illustrate all electrical equipment proposed to be contained therein. Include top and bottom elevations of all electrical equipment. The Drawings shall be prepared utilizing the dimensions contained in the individual equipment submittals. Indicate code and manufacturer's required clearances and access points.
  - c. Illustrate all other equipment therein such as conduits, detectors, luminaries, ducts, registers, pull boxes, wireways, structural elements, etc.
  - d. Indicate the operating weight of each piece of equipment.
  - e. Indicate the heat release from each piece of electrical equipment in terms of BTU per hour. This information shall be that which is supplied by the respective manufacturers.
  - f. Illustrate concrete housekeeping pads and curbs.
  - g. Indicate dimensions to confirm compliance with code-required clearances.
  - h. Indicate maximum normal allowable operating temperature for each piece of equipment (as per each respective manufacturer's recommendation).
  - i. Equipment removal routes.
2. Provide  $\frac{1}{4}$ " = 1'-0" plans of point-to-point routing of conduits with size and function between switchboards, transformers, panelboards, distribution boards, transfer switches, maintenance panels, generators, protective relaying, generator control cabinets etc. All conduit 2" in diameter and greater shall be indicated in the model.
- P. The work described in shop drawing submissions shall be carefully checked by all trades for clearances (including those required for maintenance and servicing), field conditions, maintenance of engineering conditions and coordination with other trades on the job. Each submitted shop drawing shall include a certification that related job conditions have been checked by the Contractor and each Subcontractor and that conflicts do not exist.
- Q. The Contractor is not relieved of the responsibility for dimensions or errors that may be contained on submissions, or for deviations from the requirements of the Contract Documents. The noting of some errors but overlooking others does not grant the Contractor permission to proceed in error.
- R. Inadequate or incomplete shop drawings, product data and/or samples will not be reviewed and will be returned to the Contractor marked "Revise and Resubmit" for resubmittal.
- S. Indicate the following on the lower right-hand corner of each shop drawing and on the front cover of each product data brochure cover: The submittal identification number; title of the sheet or brochure; name and location of the project; names of the Engineer, Engineer, Contractor, Subcontractor, manufacturer, supplier, and vendor; the date of submittal; and the date of each correction, version and revision. Number all pages and drawings in product data brochures consecutively from beginning to end. Unless the above information is included, the submittal will be returned for resubmission. Resubmittals of product data or brochures shall include a cover letter summarizing the corrections made in response to the review comments.

### 3.3 COORDINATION OF WORK

- A. The Contract Documents establish scope, materials and quality but are not detailed installation instructions. Drawings are diagrammatic.
- B. Coordinate work with related trades and furnish, in writing, any information necessary to permit the work of related trades to be installed satisfactorily and with the least possible conflict or delay.
- C. The electrical drawings show the general arrangement of equipment and appurtenances. Follow these drawings as closely as the actual construction and the work of other trades will permit. Provide offsets, fittings, and accessories, which may be required but not shown on the Drawings. Investigate the site, note construction conditions, wall materials, ceiling heights and review drawings of other trades to determine conditions affecting the work and provide such work and accessories as may be required to accommodate such conditions. Additional costs as a result of the failure to investigate the site will not be paid.
- D. The locations of receptacles, outlets, panels and other equipment indicated on the Drawings are approximately correct, but they are understood to be subject to such revision as may be found necessary or desirable at the time the work is installed in consequence of increase or reduction of the number of outlets, or in order to meet field conditions, or to coordinate with modular requirements of ceilings, or to simplify the work, or for other legitimate causes.
- E. Exercise particular caution with reference to the location of panels, receptacles, outlets, switches, fire alarm devices, and have precise and definite locations accepted by the Engineer before proceeding with the installation.
- F. The Drawings show only the general run of large raceways and approximate locations of receptacles and outlets. Any significant changes in location of receptacles and outlets, cabinets, etc., necessary in order to meet field conditions shall be brought to the immediate attention of the Engineer for review before such alterations are made. Modifications shall be made at no additional cost.
- G. Verify with the Engineer the exact location and mounting height of outlets and equipment not dimensionally located on the Drawings prior to installation.
- H. Circuit tags in the form of numbers are used where shown to indicate the circuit designation numbers in electrical panels. Show the actual circuit numbers on the as-built Record Drawings and on the associated typed panelboard directory card. Where circuiting is not indicated, provide required circuiting in accordance with the loading indicated on the Drawings and/or as directed.
- I. The Drawings generally do not indicate the quantity of wires in conduit for the branch circuit wiring of fixtures and outlets, or the actual circuiting. Provide the correct conductor size and quantity as required by the indicated circuiting and/or circuit numbers indicated, the control intent, referenced wiring diagrams (if any), the specified voltage drop or maximum distance limitations, and the applicable requirements of the NEC.
- J. Carefully check space requirements with other trades to ensure that equipment can be installed in the spaces allotted.
- K. Wherever work interconnects with work of other trades, coordinate with other trades to ensure that they have the information necessary so that they may properly install the

necessary connections and equipment. Identify pull boxes requiring access in order that the ceiling trade will know where to install access doors and panels.

- L. Consult with other trades regarding equipment so that, wherever possible, motor controls and distribution equipment are of the same manufacturer.
- M. Furnish and set sleeves for passage of electrical risers through structural masonry and concrete walls and floors and elsewhere as required for the proper protection of each electrical riser passing through building surfaces.
- N. Provide firestopping matching the wall or partition rating around all pipes, conduits, ducts, sleeves, etc. which pass through rated walls, partitions and floors.
- O. Provide detailed information on openings and holes required in precast members for electrical work.
- P. Provide required supports and hangers for conduit and equipment, designed so as not to exceed allowable loadings of structures.
- Q. Examine and compare the Contract Documents with the drawings and specifications of other trades and report any discrepancies between them to the Engineer and obtain written instructions for changes necessary in the work. Install and coordinate the work in cooperation with other related trades. Before installation, make proper provisions to avoid interferences.
- R. Wherever the work is of sufficient complexity, prepare additional detail drawings to scale to coordinate the work with the work of other trades. Detailed work shall be clearly identified on the Drawings as to the area to which it applies. Submit these drawings to the Engineer for review. At completion include a set of these drawings with each set of Record Drawings.
- S. Furnish services of an experienced Superintendent, who shall be in constant charge of all work, and who shall coordinate work with the work of other trades. No work shall be installed before coordinating with other trades.
- T. Before commencing work, examine adjoining work on which this work is in any way affected and report conditions, which prevent performance of the work. Become thoroughly familiar with actual existing conditions to which connections must be made or which must be changed or altered.
- U. Adjust location of conduits, panels, equipment, etc., to accommodate the work to prevent interferences, both anticipated and encountered. Determine the exact route and location of each conduit prior to fabrication.
  - 1. Right-of-Way: Lines which pitch have the right-of-way over those which do not pitch. For example: condensate, steam, and plumbing drains normally have right-of-way. Lines whose elevations cannot be changed have right-of-way over lines whose elevations can be changed.
  - 2. Provide offsets, transitions and changes in direction of conduit as required to maintain proper headroom and pitch on sloping lines.
- V. In cases of doubt as to the work intended, or in the event of need for explanation, request supplementary instructions from the Engineer.

- W. Reflected Ceiling Plans: ceiling plans, sections, and other necessary details showing dimensioned layouts for equipment located in or on the ceiling plane. Base dimensions on exact dimensioned data obtained from product submittals for products to be included in the Work. Differentiate between field measurements and assumed dimensions. Include the following items coordinated with each other, based on input from installers of the items involved:
1. Suspended ceiling components.
  2. Structural members
  3. Sprinklers, sprinkler mains.
  4. Fire Alarm initiating and indicating devices,

### 3.4 CONTRACTOR'S COORDINATION DRAWINGS

- A. The Contractor shall coordinate efforts of all trades and shall provide (in writing, with copies to the Engineer) any information necessary to permit the work of all trades to be installed satisfactorily and with the least possible interference or delay.
- B. The Contractor and all trade contractors shall prepare a complete set of construction Coordination Drawings indicating the equipment actually purchased and the exact routing for all lines such as conduit, piping, ductwork, etc., The Coordination Drawings shall be submitted complete to the Engineer, in compliance with the construction schedule for the project. The sheet metal drawings, at a scale of not less than 1/4 inch to 1 foot, shall serve as the base drawings to which all other Contractors shall add their work. Each separate trade contractor shall draw their work on separate layers or worksets with different color assignments to facilitate coordination. Each Coordination Drawing shall be completed and signed off by the other Trade Contractors and the Contractor prior to the installation of the mechanical, plumbing, electrical and fire protection and sprinkler work in the area covered by the specific drawing. The Contractor's work shall be installed according to the shop drawings and coordination drawings. If the Contractor allows one trade to install their work before coordination with the work of other trades, the Contractor shall make all necessary changes to correct the condition at no additional cost.
- C. The Contractors' Coordination Drawings shall indicate structural loads at support points for all piping 10 inch and larger, racked piping, racked conduit, busway, and suspended electrical equipment. Submit to Structural Engineer for review and approval. The elevation, location, support points, static, dynamic and expansion forces and loads imposed on the structure at support and anchor points shall be indicated. All beam penetrations and slab penetrations shall be indicated and sized and shall be coordinated. Work routed underground or embedded in concrete shall be indicated by dimension to column and building lines and shall be coordinated. Coordination Drawings shall document all required structural penetrations for initial construction. Penetrations shall be dimensioned for walls, floors and roofs. These structural coordination requirements require review and approval by the Structural Engineer prior to completion and submittal of the Drawings.
- D. This requirement for Coordination Drawings shall not be construed as authorization for the Contractor or trade contractors to make any unauthorized changes to the Contract Documents. Contract document space allocations shall be maintained such as ceiling height, designated clearance for future construction and flexibility, chase walls, equipment room size, unless prior written authorization is received from the Engineer to change them.
- E. Prior to final acceptance of the work, the Contractor shall submit the Coordination Drawings as part of the Record Drawings submittal.

### 3.5 EXAMINATION OF SITE

- A. Prior to the submitting of bids, visit the project site and become familiar with all conditions affecting the proposed installation and make provisions as to the cost thereof.
- B. The Contract Documents do not make representations regarding the character or extent of the existing structural, mechanical and electrical installations, above or below ground, or other sub-surface conditions which may be encountered during the work. Evaluate existing conditions, which may affect methods or cost of performing the work, based on examination of the site or other information. Failure to examine the Drawings or other information does not relieve the Contractor of responsibility for the satisfactory completion of the work.

### 3.6 CUTTING AND PATCHING

- A. Where cutting, channeling, chasing or drilling of floors, walls, partitions, ceilings or other surfaces is necessary for the proper installation, support or anchorage of conduit or other equipment, lay out the work carefully in advance. Repair any damage to the building, piping, equipment or defaced finished plaster, woodwork, metalwork, etc., using skilled tradespeople of the trades required at no additional cost.
- B. Do not cut, channel, chase or drill unfinished masonry, tile, etc., unless permission from the Engineer is obtained. If permission is granted, perform this work in a manner acceptable to the Engineer.
- C. Where conduit or equipment are mounted on a painted finished surface, or a surface to be painted, paint to match the surface. Cold galvanize bare metal whenever support channels are cut.
- D. Provide slots, chases, openings and recesses through floors, walls, ceilings, and roofs as required. Where these openings are not provided, provide cutting and patching to accommodate penetrations at no additional cost.

### 3.7 MOUNTING HEIGHTS

- A. Mounting heights shall conform to ADA requirements.
- B. Verify exact locations and mounting heights with the Engineer before installation.
- C. Electrical receptacles and outlets shall be mounted no higher than 48 inches above finished floor to top of the outlet box and no lower than 15 inches above finished floor to bottom of the outlet box.
- D. Electrical switches shall be mounted no higher than 48 inches above finished floor to top of the outlet box and no lower than 36 inches above finished floor to bottom of the outlet box.
- E. Fire alarm manual pull stations shall be mounted no higher than 48 inches above finished floor to top of the outlet box and no lower than 36 inches above finished floor to bottom of the outlet box.
- F. Visual Alarms: When not ceiling mounted, not less than 80 inches to the bottom or 96 inches to the top of the device.

### 3.8 CLEANING UP

- A. Avoid accumulation of debris, boxes, loose materials, crates, etc., resulting from the installation of this work. Remove from the premises each day all debris, boxes, etc., and keep the premises clean and free of dust and debris.
- B. All electrical equipment shall be thoroughly vacuumed and wiped clean prior to energizing and at the completion of the project. Equipment shall be opened for observation by the Engineer as required.

### 3.9 WATERPROOFING

- A. Avoid, if possible, the penetration of any waterproof membranes such as roofs, machine room floors, basement walls, and the like. If such penetration is necessary, make penetration prior to the waterproofing and furnish all sleeves or pitch-pockets required. Advise the Engineer and obtain written permission before penetrating any waterproof membrane, even where such penetration is shown on the Drawings.
- B. Restore waterproofing integrity of walls or surfaces after they have been penetrated without additional cost.

### 3.10 SUPPORTS

- A. Support work in accordance with the best industry practice. Provide supports, hangers, auxiliary structural members and supplemental hardware required for support of the work.
- B. Provide supporting frames or racks extending from floor slab to ceiling slab for work indicated as being supported from walls where the walls are incapable of supporting the weight. In particular, provide such frames or racks in electric closets and mechanical equipment rooms.
- C. Provide supporting frames or racks for equipment which is to be installed in a freestanding position.
- D. Supporting frames or racks shall be of standard angle, standard channel or specialty support system steel members, rigidly bolted or welded together and adequately braced to form a substantial structure. Racks shall be of ample size to assure a workmanlike arrangement of all equipment mounted on them.
- E. Adequate support of equipment (including outlet, pull and junction boxes and fittings) shall not depend on electric conduits, raceways, or cables for support.
- F. Electrical equipment or raceway shall not rest on or depend for support on suspended ceiling media (tiles, lath, plaster, as well as splines, runners, bars and the like in the plane of the ceiling). Provide independent support of electrical equipment. Do not attach to supports provided for ductwork, piping or work of other trades.
- G. Provide required supports and hangers for conduit, equipment, etc., so that loading will not exceed allowable loadings of structure. Electrical equipment and supports shall not come in contact with work of other trades.

### 3.11 FASTENINGS

- A. Fasten equipment to building structure in accordance with the best industry practice.

- B. Where weight applied to building attachment points is 100 pounds or less, conform to the following as a minimum:
1. Wood: Wood screws.
  2. Concrete and solid masonry: Bolts and expansion shields.
  3. Hollow construction: Toggle bolts.
  4. Solid metal: Machine screws in tapped holes or with welded studs.
  5. Steel decking or sub-floor: Fastenings as specified below for applied weights in excess of 100 pounds.
- C. Where weight applied to building attachment points exceeds 100 pounds, but is 300 pounds or less, conform to the following as a minimum:
1. At concrete slabs provide 24-inch by 24-inch by 1/2-inch steel fishplates on top with through bolts. Fishplate assemblies shall be chased in and grouted flush with the top of slab screed line, where no fill is to be applied.
  2. At steel decking or sub-floor for all fastenings, provide through bolts or threaded rods. The tops of bolts or rods shall be set at least one inch below the top fill screed line and grouted in. Suitable washers shall be used under bolt heads or nuts. In cases where the decking or sub-floor manufacturer produces specialty hangers to work with their decking or sub-floor, such hangers shall be provided.
- D. Where weight applied to building attachment points exceeds 300 pounds, coordinate with and obtain the approval of Engineer and conform to the following as a minimum:
1. Provide suitable auxiliary channel or angle iron bridging between building structural steel elements to establish fastening points. Bridging members shall be suitably welded or clamped to building steel. Provide threaded rods or bolts to attach to bridging members.
- E. For items, which are shown, as being ceiling-mounted at locations where fastening to the building construction element above is not possible, provide suitable auxiliary channel or angle iron bridging tying to the building structural elements.
- F. Wall-mounted equipment may be directly secured to wall by means of steel bolts. Groups or arrays of equipment may be mounted on adequately sized steel angles, channels, or bars. Prefabricated steel channels as manufactured by Kindorf or Unistrut are acceptable.

### 3.12 IDENTIFICATION

- A. Identify electrical equipment with permanently attached phenolic nameplates with 1/2-inch high white engraved lettering. Identification shall include equipment name or load served as appropriate. Nameplates shall be attached with zinc-plated screws Peel-and-stick tape or glue-on type nameplates are prohibited.
1. Nameplates for equipment connected to the normal power system shall be black with white lettering.
  2. Nameplates for equipment connected to the emergency power system shall be red with white lettering.
  3. Nameplates for equipment connected to the UPS system shall be orange with white lettering.
  4. Equipment labels to indicate voltage, conductor phasing color code and power source (fed from) information.

- B. Cable tags shall be flameproof secured with flameproof non-metallic cord.
- C. Provide an engraved nameplate for each switch controlling loads, which are not local to the switch.
- D. Wherever raceways for future use are terminated outside of the building, stake the location with a 8-foot long, 4-inch by 4-inch clear pressure treated post a minimum of 4' below grade and 4' above grade.
- E. See individual Sections for additional identification requirements.

### 3.13 PROHIBITED LABELS AND IDENTIFICATIONS

- A. In all public areas, tenant areas, and similar locations within the project, the inclusion or installation of any equipment or assembly which bears on any exposed surface any name, trademark, or other insignia which is intended to identify the manufacturer, the vendor, or other source(s) from which such object has been obtained, is prohibited, unless otherwise approved by the Engineer.
- B. Required UL labels shall not be removed nor shall identification specifically required under the various technical sections of the Specifications be removed.

### 3.14 EQUIPMENT PADS AND ANCHOR BOLTS

- A. Provide concrete pads under all floor-mounted electrical equipment. Equipment pads shall conform to the shape of the piece of equipment it serves with a minimum 1-inch margin around the equipment and supports. Pads shall be a minimum of 4 inches high and made of a minimum 28 day, 2500 psi concrete reinforced with 6-inch by 6-inch 6/6 gauge welded wire mesh. Trowel tops and sides of pad to smooth finishes, equal to those of the floors, with all external corners bullnosed to a 3/4-inch radius. Seal concrete pads where not painted. Paint pads same as surrounding floor areas. Shop drawings stamped "NO EXCEPTIONS NOTED" shall be used for dimensional guidance in sizing pads.
- B. Provide galvanized anchor bolts for all equipment placed on concrete equipment pads, inertia blocks, or on concrete slabs. Provide bolts of the size and number recommended by the manufacturer of the equipment and locate by means of suitable templates. Equipment installed on vibration isolators shall be secured to the isolator. Secure the isolator to the floor, pad, or support as recommended by the vibration isolation manufacturer.
- C. Where equipment is mounted on gypsum board partitions, the mounting screws shall pass through the gypsum board and securely attach to the partition studs. As an alternative, the mounting screws may pass through the gypsum board and be securely attached to 6 inches square, 18 gauge galvanized metal backplates, which are attached to the gypsum board with an approved non-flammable adhesive. Toggle bolts installed in gypsum board partitions are not allowed.

### 3.15 DELIVERY, DRAYAGE AND HAULING

- A. Provide drayage, hauling, hoisting, shoring and placement in the building of equipment specified and be responsible for the timely delivery and installation of equipment as required by the construction schedule. If any item of equipment is received prior to the time that it is required, the Contractor shall be responsible for its proper storage and protection until the time it is required. Pay for all costs of drayage or storage.

- B. If equipment is not delivered or installed at the project site in a timely manner as required by the project construction schedule, the Contractor shall be responsible for resulting disassembly, re-assembly, manufacturer's supervision, shoring, general construction modification, delays, overtime costs, etc., at no additional cost.

### 3.16 EQUIPMENT AND MATERIAL PROTECTION

- A. Protect the work, equipment, and material of other trades from damage by work or workmen of this trade, and correct damaged caused without additional cost.
- B. Take responsibility for work, materials, and equipment until finally inspected, tested and accepted. Protect work against theft, injury, or damage, and carefully store material and equipment received on site, which is not immediately installed. Close open ends of work with temporary covers or plugs during construction to prevent entry of obstructing material. Cover and protect equipment and materials from damage due to water, spray-on fireproofing, construction debris, etc. Store equipment sensitive to moisture damage in dry, heated spaces.
- C. Provided adequate means for fully protecting finished parts of materials and equipment against damage from whatever cause during the progress of the work until final acceptance. Protect materials and equipment in storage and during construction in such a manner that no finished surfaces will be damaged or marred, and moving parts are kept clean and dry. Do not install damaged items; take immediate steps to obtain replacement or repair.
- D. Lighting fixture troffers with parabolic reflectors shall be installed with factory-mounted plastic protective bags around parabolic reflector assembly. Remove protective bag just prior to occupancy.

### 3.17 TESTING OF ELECTRICAL SYSTEMS

- A. Comply with the project construction schedule for the date of final performance and acceptance testing, and complete work sufficiently in advance of the Contract completion date to permit the execution of the testing prior to occupancy and Contract close-out. Complete any adjustments and/or alterations, which the final acceptance tests indicate as necessary for the proper functioning of all equipment prior to the completion date. See individual Sections for extent of testing required.
- B. Provide a detailed schedule of completion indicating when each system is to be completed and outlining when field testing will be performed. Submit completion schedule for review within six months after the notice to proceed by Owner's Representative has been given. Update this schedule periodically as the project progresses.

### 3.18 OPERATING INSTRUCTIONS

- A. Provide the services of factory-trained specialists to provide an operating instructions seminar for equipment and systems. The seminar shall be conducted over a five-day (consecutive) period. Instruction time is defined as straight time working hours and does not include nights, weekends, or travel time to and from the project. Ownership has the right to video record the seminars.
- B. Submit seminar agenda, schedule and list of representatives to the Engineer for approval 30 days prior to suggested date of seminar. Do not commence seminar until the

Engineer has issued a written acceptance of the starting time and attendees. Confirm attendance of seminar by written notification to participants.

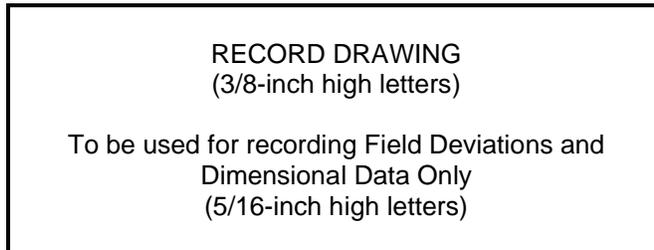
- C. Instruct Owner's operating personnel in proper starting sequences, operation, shut-down, general maintenance and preventative maintenance procedures, including normal and emergency procedures.
- D. Submit final copies of Record Drawings and Operating and Maintenance Manuals to Owner at seminar.
- E. Submit a written record of minutes and attendees of the seminar to the Owner.

### 3.19 OPERATING AND MAINTENANCE MANUALS

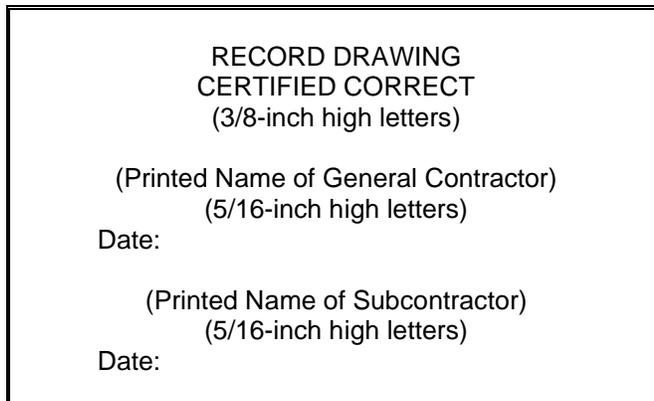
- A. Provide Operating and Maintenance Manuals for equipment and materials furnished under this Division.
- B. Submit electronic copies of all operating and maintenance data books for review at least ten (10) weeks before the completion date. Assemble data in a completely indexed volume or volumes and identify the size, model, and features indicated for each item.
- C. Maintenance manuals shall include complete cleaning and servicing data compiled in a clear and easily understandable format. Show model numbers of each piece of equipment, complete lists of replacement parts, capacity ratings, and actual loads.
- D. Provide the following information where applicable:
  - 1. Identifying name and mark number
  - 2. Locations (where several similar items are used, provide a list)
  - 3. Complete nameplate data
  - 4. Certified Record Drawings and Final Reviewed submittals
  - 5. Parts list
  - 6. Performance curves and data
  - 7. Wiring diagrams
  - 8. Manufacturer's recommended operating and maintenance instructions with all non-applicable information deleted
  - 9. List of spare parts recommended for normal service requirements
  - 10. Assembly and disassembly instructions with exploded-view drawings where necessary
  - 11. Test reports
  - 12. Trouble shooting diagnostic instructions, where applicable
- E. After the Engineer's and Engineer's review, and any required Contractor revisions, submit a complete electronic copy, along with three (3) final hard copies of operating and maintenance data books for the following systems:
  - 1. Transformers
  - 2. Switchboards
  - 3. Panelboards
  - 4. Disconnect Switches
  - 5. Fire Management System

3.20 RECORD DRAWINGS

- A. The Contractor shall maintain, on a daily basis, at the Project site a complete set of Record Drawings. The Record Drawings shall initially consist of a set of black line plots or 3D BIM files of the Contractor's Coordination Drawings. The prints shall be marked or the 3D BIM files electronically updated to show the precise location of all buried or concealed work and equipment, including embedded conduit, raceways and boxes, and all changes and deviations in the Electrical work from that shown on the Contract Documents. This requirement shall not be construed as authorization for the Contractor to make changes in the layout or work without definite written instructions from the Engineer or Engineer. The updated Coordination Drawings shall be used to produce the final Record Drawings that shall be delivered to the Owner in electronic format media upon Project completion.
- B. The Contractor shall conduct monthly/quarterly walk-throughs of the project site with the Owner for verification of as-built conditions with the record drawings being maintained by the Contractor. Walk-throughs shall be scheduled by the Contractor prior to close-ins. Notify the Owner in writing at least three (3) days before walk-through.
- C. Record dimensions clearly and accurately to delineate the work as installed. Suitably identify locations of all equipment by at least two dimensions to permanent structures.
- D. The Contractor and Subcontractor shall mark all in-progress Record Drawings on the front lower right hand corner with a rubber stamp impression or an electronic image similar to the following:



- E. Upon completion of the work, the Contractor and Subcontractor(s) shall certify all Record Drawings on the front lower right hand corner adjacent to the above marking with a rubber stamp impression or an electronic image similar to the following:



- F. Prior to final acceptance of the Work of this Division, the Contractor shall submit properly certified Record Drawings to the Engineer and Engineer for review and shall make

changes, corrections, or additions as the Engineer and/or Engineer may require to the Record Drawings. After the Engineer's and Engineer's review, and any required Contractor revisions, the Record Drawings shall be delivered to the Owner on electronic media in. Three (3) complete and bound hard copies shall be provided to the Owner. The Engineer and Engineer do not assume any responsibility for the accuracy or completeness of the Record Drawings.

3.21 FINAL PUNCHLIST

- A. Prior to the Final Punchlist, certify that systems and equipment are complete, operational, and are in compliance with the Contract Documents.
- B. During the Final Punchlist, provide personnel with access keys, hand held radios or other communication devices, and necessary expertise to operate each system and piece of equipment to demonstrate operational compliance with the Contract Documents.
- C. Any deficiencies noted on the Final Punchlist shall be expeditiously corrected and certified in writing.

3.22 EARLY OCCUPANCY

- A. Complete those systems which are necessary to allow partial early occupancy of the building.
- B. Verify and comply with requirements for temporary occupancy with the local Building and Fire Departments.

**END OF SECTION 26 05 01**

## SECTION 26 05 02

### EQUIPMENT CONNECTIONS AND COORDINATION

#### PART 1 – GENERAL

##### 1.1 DESCRIPTION

- A. Provide equipment connections and coordination in accordance with the Contract Documents.

##### 1.2 SUBMITTALS

- A. Fusible and non fusible safety switches
- B. Thermal over loads
- C. Variable frequency drives specified under Division 23
- D. Magnetic across the line starters

#### PART 2 – PRODUCTS

NOT APPLICABLE

#### PART 3 – EXECUTION

##### 3.1 GENERAL

- A. Provide equipment connections and coordination in accordance with manufacturer's recommendations and product submittals.
- B. Provide disconnect switches for equipment. Where equipment nameplate requires fuse protection, provide fusible type disconnect switches with fuses rated in accordance with equipment manufacturer's requirements. Circuit breakers rated HACR and recognized by the manufacturer of the equipment as suitable for fuse protection will suffice. Disconnect switches for single-phase equipment shall be thermal overload type. Locate disconnect switches in coordination with the layout of equipment. Provide supports for a free-standing installation if required to allow access to disconnect switch and/or proximity to equipment served.
- C. Provide final connections to hard-wired equipment with a minimum of two feet of flexible metal conduit or liquid-tight flexible metal conduit where required by code and in damp or wet locations.
- D. Verify the requirements of cord and plug equipment and provide receptacles, branch circuiting and branch circuit overcurrent protection to match. Receptacle types shown on the Drawings are for bidding purposes only. Coordinate actual NEMS configuration with equipment plug style.
- E. Where equipment is fed from overhead, support conduit on flanged floor type fitting.

### 3.2 EQUIPMENT CONNECTION TYPES

- A. Provide equipment connection types as indicated on the equipment connection schedule.
- B. Equipment Connection Types:
  - 1. Type DP: Duplex pump system with controller provided under Division 23. Provide connection to controller and connections from controller to pumps in accordance with the controller manufacturer's installation instructions. Provide connections for local controls and alarms in accordance with the controller manufacturer's installation instructions.
  - 2. Type FR: Fractional horsepower single-phase motor. Provide thermal overload/disconnect switch and motor connection.
  - 3. Type FWS: Equipment furnished with starter. Install starter and provide connection to starter and connection from starter to equipment.
  - 4. Type M: Motor with starter provided under Division 26. Provide disconnect switch and motor connection.
  - 5. Type SPC: Single point connection. Provide single point connection to equipment provided with factory-mounted starter/controller listed for single point power connection. Where required by code or the equipment manufacturer, provide fusible disconnect switch with fuses sized in accordance with equipment nameplate requirements.
  - 6. Type VFD: Variable frequency drive furnished under Division 23. Install VFD and provide connection to VFD and connection from VFD to equipment.

### 3.3 MECHANICAL AND PLUMBING EQUIPMENT

- A. Provide electrical connections to mechanical, plumbing and fire protection equipment.
- B. Where motor controllers are furnished by others, provide connections at line side of controllers.
- C. Where reduced voltage, multiple speed, duplex, triplex, lead-lag, pony motor or other unusual controller types are utilized, coordinate specific requirements of motor(s) and controller and provide connections at line side of controllers.
- D. Provide branch circuits and connections for control power as required by controls contractor.
- E. Where electric duct heaters are provided with remote power panels, provide branch circuits between remote panel and duct heater elements in accordance with the equipment manufacturer's recommendations.
- F. Provide final connections between controller and equipment.
- G. Provide a separate light and graphics on the fire alarm graphic annunciator for each pre-action control panel.
- H. Provide audible, visual and combination audible visual devices in the protected area that are connected to the fire suppression pre-action control panel. Provide a laminated placard for each device identifying its connection to the pre-action system.

**END OF SECTION 26 05 02**

**SECTION 26 05 19**  
**600V WIRE AND CABLE**

**PART 1 – GENERAL**

1.1 DESCRIPTION

- A. Provide 600V wire and cable in accordance with the Contract Documents.
- B. Related work specified in other divisions of these specifications.
  - 1. Raceways and Boxes

1.2 REFERENCE STANDARDS

- A. Rubber Insulated Wire and Cable: ICEA S-19-81, NEMA WC 3, and UL 44.
- B. Thermoplastic Insulated Wire and Cable: ICEA S-61-402, NEMA WC 3, and UL 83.
- C. Cross-Linked Thermosetting Polyethylene Insulated Wire and Cable: ICEA S-66-524, NEMA WC 7, and UL 44.
- D. Service Entrance Cable: UL 854.
- E. Annealed Copper Wire for Conductors: ASTM B-3.
- F. Aluminum wire: AA8176
- G. Terminal Blocks: UL 1059.

1.3 QUALITY ASSURANCE

- A. Wire and cable shall be of the same manufacturer.

1.4 SUBMITTALS

- A. Provide a compliance / non-compliance specification attached to the front of the submittal. Identify each paragraph stating the submittal complies with the specification or does not comply. For every statement of non-compliance, include clear language as to the reason for the non-compliance and the submitted provisions that are intended to operate in its place.
- B. Field test reports.
- C. Building wire. Copper
- D. Metal Clad Cable.
- E. Armored Clad (AC) Cable. Prohibited.
- F. Underground Feeder (UF) cable. Prohibited.

- G. Non Metallic (NM) cable. Prohibited.

## 1.5 FIELD TESTING

- A. Inspect splices and terminations and make mechanically and electrically tight during the 15-day period immediately prior to final acceptance of the work.
- B. Feeder insulation shall be tested after installation, and before final connection.
  - 1. Tests shall be performed with a 500 volt megger, and conductors shall test free from short circuits and grounds.
  - 2. Conductors shall be tested phase-to-phase and phase-to-ground, phase-to-neutral.
  - 3. Furnish the instruments, materials, and labor required.
- C. Demonstration: Subsequent to wire and cable installation and connection, energize circuits and demonstrate functioning in accordance with contract requirements. Correct deficiencies and retest to demonstrate compliance.
- D. Record and document testing and submit to owner. Documentation shall include project name and address, testing agency name and address, testers name and employee number, feeder origin, destination, size, length, conduit size and material, anticipated testing result range and actual test results. In the event the feeder fails the test, include a corrective action and anticipated time line for completion. All feeders shall be tested and retested until all feeders pass and results are documented.

## PART 2 – PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Wire and Cable:
  - 1. Copper:
    - a. Southwire 600 Volts. Copper Conductor. Thermoplastic Insulation/Nylon Sheath, Heat, Moisture, Gasoline and Oil Resistant II. All sizes rated both THHN and either THWN (sizes 14, 12, and 10 AWG) or THWN-2 (sizes 8 AWG and larger and 14, 12, 10 AWG
    - b. 600 Volts & 1000 Volts Copper Conductor. Cross-Linked Polyethylene (XLPE) Insulation. High-Heat and Moisture Resistant.
    - c. Underground Service Entrance Cable. 600 Volt. Copper conductors. Cross-Linked Polyethylene (XLP) Insulation. High-Heat, Moisture, and Sunlight Resistant. RHH, RHW-2, USE-2.
    - d. SIMpull® THHN THWN-2 MTW / c(UL) T90 Nylon TWN75 Copper Conductor, 600V, Thermoplastic-Insulated Cable,
    - e. Alcan, Triangle, Anaconda, Brand-Rex, National, Okonite, Simplex meeting the specifications will be considered.
- B. Connectors:
  - 1. Wire size AWG number 14 through AWG number 6:

- a. Hand applied: Piggy (Thomas & Betts), Scotchlock (3M), or Wing Nut (Ideal).
  - b. Tool applied: Burndy HYDENT, or Thomas & Betts Stakon.
  - c. WAGO's 221 Series Splicing Lever Nuts Connectors connect solid, stranded and fine-stranded conductors ranging from 24–10 AWG.
2. Copper Wire size number 4 through number 1000 kcmil:
- a. IlSCO NIMBUS PBT INS BLK SPL / OFFSET: UL Listed and CSA Certified.
  - b. 600 volt at 90 Deg C.
  - c. Dual rated for copper and aluminum.
  - d. Removable port and screw plugs.
3. For feeder ampacity as rated.
- C. Electrical Tape:
- 1. Insulating type, Johns-Manville or 3M, UL Listed for the use.

2.2 WIRE AND CABLE

- A. General:
- 1. 600V minimum insulating rating.
- B. Conductor:
- 1. Electrical grade, annealed copper, tinned if rubber insulated, and fabricated in accordance with ASTM and ICEA standards. Minimum size number 12 for branch circuits; number 14 for control wiring. Switch legs are not considered control wiring.
- C. Stranding and Number of Conductors:
- 1. Number 12 and number 10 shall be solid.
  - 2. Larger than number 10, stranded ASTM Class B.
  - 3. Control wires stranded in accordance with ASTM Class B stranding designations.
  - 4. Cables for low-voltage systems shall be specified in other sections.
- D. Insulation:
- 1. 600 volts, PVC insulation, nylon jacket, surface-printed identification, listed as type THHN, THWN, THHW, THW-2, THWN-2, XHHW, XHHW-2 per UL 83.
- E. Color Coding:
- 1. Wiring shall be color coded as follows:

Conductor	120/208V System	277/480V System
Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White	Gray
Ground	Green	Green

Conductor	120/208V System	277/480V System
Isolated Ground	Green/Yellow Stripe	

- 2. Wire number 8 and smaller shall be factory-color coded the entire length. Wire number 6 and larger shall be color coded by color taping entire length of exposed conductor at all accessible locations or factory-color coded where available.
- 3. Control wiring shall be color coded in accordance with manufacturer's recommendations and as elsewhere specified

2.3 MC FEEDER CABLE – COPPER CONDUCTORS

- A. Prohibited

2.4 SERVICE ENTRANCE CABLE SE TYPE R

- A. Prohibited

2.5 NM-B COPPER CONDUCTOR-600V

- A Prohibited

2.6 Shielded variable frequency drive cable:

- A. Shielded conductor and signal cable with symmetric bare grounds and overall shield to block emi and rfi interference.
- B. Conductor Material: stranded tinned copper
- C. Shield: Foil tape and tinned copper braid shield
- D. Comply with 2000V UL 1277 Type TC-ER per 2005 NEC Article 336
- E. Rated for 90°C wet/dry
- F. Suitable for Class I & II; Division 2 hazardous location
- G. Comply with UL 1685 vertical tray flame test
- H. Comply with IEEE 1202 vertical tray flame test at 70,000 BTU/hour
- I. Comply with CSA FT4
- J. Comply with Oil & Sunlight resistant
- K. RoHS compliant and CE approved.

2.7

**PART 3 – EXECUTION**

1.1 GENERAL

- A. Maximum of three branch circuits in one conduit unless otherwise indicated.
- B. Do not install wire until raceway systems are complete.
- C. Provide cable supports for vertical risers as required by all applicable codes
- D. Wire size shall be uniform for the entire length of the circuit unless noted otherwise.
- E. Do not splice feeders or dedicated branch circuits unless otherwise indicated.
- F. Make connections, splices, taps, and joints with solderless devices, mechanically and electrically secure.
- G. Lubricate cables to facilitate pulling as required by cable manufacturer. Lubrication material shall be inert to cable insulation and raceways.
- H. Where compression connectors are used, provide connectors with hydraulic die, embossing die code into connector. Connect to bus with Bellville type washers for positive pressure over complete contact area. Insulate with heat shrink tubing.
- I. Provide a separate neutral for ground fault interrupter branch circuits.
- J. Exposed feeders and branch circuits shall be electric metal tubing.

#### 1.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN-THWN or XHHW, THW-2, THWN-2, XHHW-2 , single conductors in raceway.
- B. Exposed Feeders: Type THHN-THWN, THW-2, THWN-2, XHHW-2 single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace serving House or Common Area loads: Type THHN-THWN, THW-2, THWN-2, XHHW-2 single conductors in raceway or Metal-clad cable, Type MC.
- D. Exposed Branch Circuits: Type THHN-THWN, THW-2, THWN-2, XHHW, XHHW-2 single conductors in raceway.
- E. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, THW-2, THWN-2, XHHW, XHHW-2 single conductors in raceway.
- F. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- G. Class 2 Control Circuits: Power-limited cable, concealed in building finishes.

#### 1.4 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal raceways and cables in finished walls, ceilings, and floors, unless otherwise indicated.

- B. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- C. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

#### 1.5 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 and UL 486B.
- B. Make splices 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 (150 mm) of slack conductor extending past the front of the box.

#### 1.6 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

**END OF SECTION 26 05 19**

**SECTION 26 05 26**  
**GROUNDING SYSTEM**

**PART 1 – GENERAL**

1.1 DESCRIPTION

- A. Provide electrical grounding systems in accordance with the Contract Documents and as specified herein.

1.2 QUALITY ASSURANCE

- A. Utility company approval of service installation.

1.3 REFERENCE STANDARDS

- A. UL 467.
- B. ANSI C-1.
- C. IEEE 142.
- D. NEC.
- E. National Electrical Safety Code.
- F. Utility company requirements.
- G. All equipment and material to be furnished and installed on this project shall be UL listed, in accordance with the requirements of the authorities having jurisdiction, and suitable for its intended use on this project.

1.4 SUBMITTALS

- A. Field test report.
- B. Provide a compliance / non-compliance specification attached to the front of the submittal. Identify each paragraph stating the submittal complies with the specification or does not comply. For every statement of non-compliance, include clear language as to the reason for the non-compliance and the submitted provisions that are intended to operate in its place.

1.5 FIELD TESTING

- A. Resistance testing of ground rod system indicating maximum 5 ohms resistance to ground.

1.6 IDENTIFICATION

- A. Label each end of each grounding electrode conductor, identifying the connection point of the opposite end of the conductor.

## **PART 2 – PRODUCTS**

### **2.1 GENERAL**

- A. Grounding connections shall be brazed, molded exothermic welded, bolted clamp terminal bars, or listed pressure connector type.
- B. All equipment and materials provided under this section of the Specifications shall be new, UL listed and bear the UL label.
- C. All switchboards, panelboards, motor control centers, transformers, busway, etc. shall be provided with a copper equipment ground bar bolted, brazed or riveted to the associated enclosure or cabinet. Refer to each individual equipment Specification section for additional grounding requirements.
- D. All receptacles, switches, disconnects and devices shall be provided with a grounding terminal connected to the device frame and the enclosure. Refer to each individual equipment Specification section for additional grounding requirements.
- E. All conduit, raceways, junction boxes, pull boxes, etc., shall be made electrically continuous by means of grounding conductors, bonding jumpers, grounding bushings, etc., as required by the NEC and the authorities having jurisdiction.

## **PART 3 – EXECUTION**

### **3.1 GENERAL**

- A. Metallic raceways, enclosures, equipment frames, fittings, and other metallic noncurrent-carrying equipment parts and surfaces shall be effectively bonded to the grounding system. Nonconductive paint, enamel, or similar coating shall be removed at threads and contact surfaces to preserve grounding continuity or fittings shall be provided to make such removal unnecessary.
- B. Neutral wiring shall be grounded at the system point of origin only and shall be isolated from downstream grounding systems.
- C. Provide an insulated grounding conductor for all segments of branch circuits.
- D. Receptacles shall be grounded to the outlet box by means of a bonding jumper between the outlet box and the receptacle grounding terminal.
- E. Branch circuits shall be provided with an insulated grounding conductor run with the circuit conductors. This grounding conductor shall be in addition to the ground path provided by the continuously grounded metallic raceway system that encloses the phase and neutral conductors.
- F. Provide bolted clamp terminal connectors where connected to removable equipment.

**END OF SECTION 26 05 26**

## SECTION 26 28 16

### DISCONNECT SWITCHES AND INDIVIDUAL MOTOR CONTROLLERS

#### PART 1 – GENERAL

##### 1.1 DESCRIPTION

- A. Provide disconnect switches and individual motor controllers in accordance with the Contract Documents.

##### 1.2 QUALITY ASSURANCE

- A. Disconnects and individual motor controllers shall be of the same manufacturer.

##### 1.3 REFERENCE STANDARDS

- A. Disconnect Switches:
  - 1. Federal Specification W-S-865C
  - 2. NEMA KS1
  - 3. UL 98 (File #4776) and 508
- B. Individual Motor Controllers:
  - 1. NEMA ICS 2-321
  - 2. UL 547, 845 and 1004

##### 1.4 SUBMITTALS

- A. All disconnect ratings and voltages.
- B. Provide a compliance / non-compliance specification attached to the front of the submittal. Identify each paragraph stating the submittal complies with the specification or does not comply. For every statement of non-compliance, include clear language as to the reason for the non-compliance and the submitted provisions that are intended to operate in its place.
- C. Submittal shall include highlighted equipment specific for the project. Irrelevant information not pertaining to the project shall be stricken accordingly.

##### 1.5 FIELD TESTING

- A. Test each individual motor controller circuit and verify proper operation.

##### 1.6 IDENTIFICATION

- A. Provide an identification nameplate for each disconnect switch and individual motor controller.

## **PART 2 – PRODUCTS**

### **2.1 ACCEPTABLE MANUFACTURERS**

- A. Siemens, Square D, Cutler Hammer (Eaton), or General Electric (ABB).

### **2.2 DISCONNECT SWITCHES**

- A. Heavy duty for 800A or less, horsepower rated, quick-make, quick-break, dead-front type. Self-contained unit in a NEMA 1 enclosure (NEMA 3R, gasketed where installed outdoors or where exposed to water spray, dust or dirt), externally operable from the front.
- B. Defeatable interlock to prevent opening the door when the switch is in the ON position. Handle shall be capable of being padlocked in the OFF position.
- C. Fusible switches shall be equipped with rejecting type clips suitable for UL Class R fuses up to 600A, suitable for UL Class L fuses above 600A. Interrupting rating shall be 200,000 RMS-symmetrical amperes.
- D. Voltage, ampacity, horsepower rating, and number of poles shall be appropriate for system and load served. Provide neutral pad for circuits with neutral conductors. Provide ground lug.

## **PART 3 – EXECUTION**

### **3.1 GENERAL**

- A. Disconnect switches and individual motor controller shall be installed within ten feet of load served and installed within sight of the motor.
- B. Provide independent support; do not mount on the housing of the equipment served.
- C. Conduit connected between disconnect switch or individual motor controller and load served shall be flexible metal conduit where used indoors and liquid-tight flexible metal conduit where used outdoors or connected to a NEMA 3R rated device, 24 inches minimum length, 36 inches maximum length.

**END OF SECTION 26 28 16**