

## **PROJECT MANUAL**

Including Bid Documents, Contract Documents and Specifications for the construction of the:

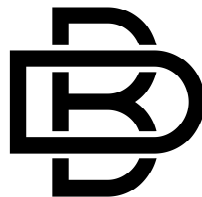
### **INTERIOR OFFICE REMODEL FOR:**



**SUPPORTING INDIVIDUALS WITH  
DISABILITIES FOR OVER 40 YEARS**

500 NE Colbern Road  
Lee's Summit, Missouri 64086

**Prepared by:**



**BUXTON KUBIK DODD**  
**DESIGN COLLECTIVE**

3100 S. National Avenue, Suite 300 Springfield, Missouri 65807  
Phone: (417) 890-5543 Fax: (417) 890-5563

Architect's Job Number:  
**2879**

Date of issue:  
**March 25, 2024**

**SECTION 000002 - PROJECT DIRECTORY**

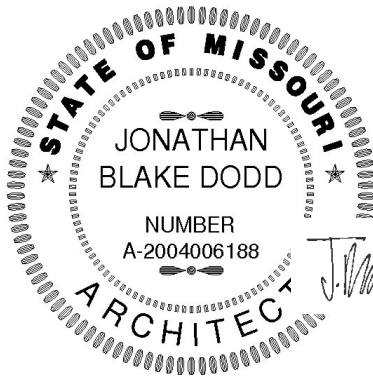
Building Owner/Tenant:	The Arc of the Ozarks 1501 E. Pythian St. Springfield, MO 65802 417-864-7887
General Contractor:	Q & Company 2106 East Central Court, Suite 100 Springfield, Missouri 65802 417-863-6700 417-863-6701 – Fax Contact: Cody Elliott, Construction Manager <a href="mailto:codyelliott@qandcompanyllc.com">codyelliott@qandcompanyllc.com</a>
Architect / MEP Engineer:	Buxton Kubik Dodd Design Collective 3100 S. National Avenue, Suite 300 Springfield, Missouri 65807 417-890-5543 417-890-5563 - Fax Contact: Jonathan Dodd, AIA NCARB, <a href="mailto:jdodd@bk-dc.com">jdodd@bk-dc.com</a> Contact: Larry Phillips, PE, <a href="mailto:lphillips@bk-dc.com">lphillips@bk-dc.com</a> Contact: Lisa Wampler, ASID, <a href="mailto:lwampler@bk-dc.com">lwampler@bk-dc.com</a>

**END OF PROJECT DIRECTORY**

## **REGISTRANTS**

The personal seal of the registered Architect or Engineer shall be the legal equivalent of his signature whenever and wherever used, and the owner of the seal shall authenticate this sheet and the specification sections pertaining to this sheet. Responsibility shall be disclaimed for all other plans, specifications, estimates, reports or other documents or instruments relating to or intended to be used for any part or parts of this project.

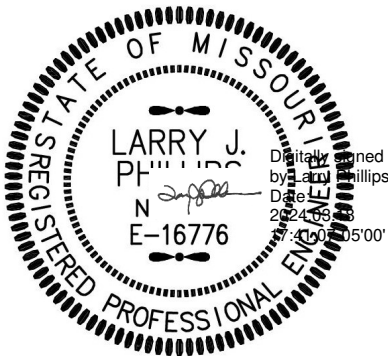
Those sections each discipline is responsible for shall be as listed alongside seal of same.



### **ARCHITECT**

Sections: Divisions: 0, 1, 2, 3, 5, 6, 7, 8, 9, 10, 12, 13 and 32.

Digitally signed  
by Jonathan Dodd  
Date: 2024.03.18  
16:11:07-05'00'



### **MEP ENGINEER**

See Drawings for Mechanical, Electrical, Plumbing Specifications

LARRY J. PHILLIPS, ENGINEER  
MO.#: E-16776

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N/A

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N/A

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N/A

## **SECTION 000100 – INSTRUCTIONS TO BIDDERS**

### **1. THE WORK**

- A. An Interior Office Building Renovation *for the Arc of the Ozarks*, at 500 NE Colbern Road, Lee’s Summitt, Missouri. All work is indicated in the drawings and specifications.

### **2. SECURING DOCUMENTS**

All Contractor copies of the proposed Contract Documents may be obtained in hard copy and/or digital format from:

Q & Company  
2106 East Central Court, Suite 100  
Springfield, Missouri 65802  
417-863-6700  
Contact: Cody Elliott, Construction Manager  
[codyelliott@qandcompanyllc.com](mailto:codyelliott@qandcompanyllc.com)

### **3. EXAMINATION OF DOCUMENTS AND SITE OF WORK**

- A. Before submitting a bid, each bidder shall examine the Drawings carefully, shall read the Specifications and all other proposed Contract Documents, and shall visit the site of the Work. Each bidder shall fully inform himself prior to bidding as to existing conditions and limitations under which the Work is to be performed, and shall include in his bid a sum to cover the cost of items necessary to perform the Work as set forth in the proposed Contract Documents. No allowance will be made to a bidder because of lack of such examination or knowledge. The submission of a bid will be considered as conclusive evidence that the bidder has made such examination.

### **4. INTERPRETATION OF CONTRACT DOCUMENTS PRIOR TO BIDDING**

- A. If any person contemplating submitting a bid for construction of the Work is in doubt as to the true meaning of any part of the proposed Contract Documents, or finds discrepancies in, or omissions from, any part of the proposed Contract Documents, he must submit to the Architect a request for interpretation thereof not later than three days before bids will be opened. The person submitting the request shall be responsible for its prompt delivery.
- B. Interpretation or correction of proposed Contract Documents will be made only by Addendum and will be mailed or delivered to the General Contractor for distribution to Bidders. The Owner will not be responsible for any other explanations or interpretations of the proposed Contract Documents. Bidders are not at liberty to assume that a discrepancy or conflict thereby voids or omits any item entirely from the Contract.
- C. Discrepancies, conflicts, ambiguities, and errors which may have more than one interpretation require that the Architect make the interpretation per General Conditions of the Contract. Per Contract, the default position shall be the more restrictive and/or more costly interpretation, unless a formal interpretation is rendered by the Architect, by addendum, or in writing if occurrence is after bidding.



**5. TAX EXEMPT**

- A. Sales Tax Exemption: The Owner/Project is tax exempt.

**6. WAGE RATES**

- A. Prevailing Wage Rates: Do not apply.

**7. ASBESTOS**

- A. No asbestos products are permitted and certification of same may be required upon request. See “Summary of Work” Section 010100.
- B. Prior to commencement of the Work, the Owner shall provide the contractor with asbestos surveys and abatement certificates.

**8. MATERIALS AVAILABILITY**

- A. Prior to bidding, the Contractor shall confirm that all major materials, suppliers and subcontractors which may impact the critical path of the Construction Schedule are able to be delivered and/or provided such that the project schedule and substantial completion date are not adversely affected. The Contractor shall immediately notify the Architect of any such conflicts and adversities, prior to issuance of final addendum, prior to bidding. The Contractor bears sole and full responsibility for compliance with terms of the contract for time and completion, (except as such terms may be modified by contract modification procedures upon timely notification by the Contractor.)

**END OF INSTRUCTIONS TO BIDDERS**

**SECTION 000700 - GENERAL CONDITIONS**

General Conditions of this construction project is the AIA Document A201, Current Edition. This document is on file at Architects office and is available upon request for reference.

## SECTION 000800 - SUPPLEMENTARY CONDITIONS

### 1.1 GENERAL

- A. A copy of the Contract between the Owner and Contractor, including additional Supplementary Conditions, is on file for review in Q & Company, LLC’s office.
- B. The following supplements modify, delete from, and/or add to the General Conditions.
  - 1. All Articles, or portions thereof, which are not specifically modified, deleted, or superseded hereby, remain in full effect.
  - 2. The General Conditions also may be supplemented elsewhere in the Contract Documents by provisions located in, but not necessarily limited to, Division 1 of the Specifications.

### 1.2 ARTICLES OF SUPPLEMENTARY CONDITIONS

#### A. DRAWING COPIES:

The Contractor for General Construction will be furnished, free of charge, all usable sets of Drawings and Specifications returned after close of bidding. The Contractor may secure additional copies of prints of Drawings and Specifications from the Architect at the Architect's usual charge for reproduction and handling.

#### B. BUILDING PERMIT:

The Owner, through the Architect, will submit Drawings and Specifications to the appropriate public authorities for building permit. The Owner will pay all fees for plan review and building permit. **Separate fees for electrical, mechanical, and plumbing permits/inspections are to be included in the contract amount and paid for by the Contractor.**

#### B. CONTRACTOR'S STAMP:

The Contractor shall include an indicator stamp on all submittals and shop drawings, which indicates the Contractor has reviewed the items and found them to be in compliance with the Contract, and showing the name and date of authorized reviewer. **The Architect will not review submittals and shop drawings without the Contractors stamp affixed.**

#### C. ARCHITECT OBSERVATIONS:

Observations by the Architect shall in no way warrant or guarantee to the Owner and Contractor that all components of the work have actually been provided in exact compliance with the Contract requirements. The Contractor shall bear full responsibility for compliance with this Contract between Owner and Contractor, and for fulfillment of same.

Wherever in this Contract the term "inspection" is used as an action of the Architect, it shall mean "general observations".

The Architect’s report to the Owner regarding the general progress of the work shall be based upon general observations, and upon information provided by the Contractor including verbal reports,

pay applications, and the Contractor’s construction schedule. The Architect shall not be responsible for damages resulting from the progress, or lack thereof, of the Work.

D. ADDITIONAL INSUREDS:

**The Contractor's insurance policies shall name both the Architect and the Owner as additional insured. Copies of the Certificates of Insurance must be submitted before construction commencement.** All insurance policies shall provide that no cancellation of the policy or endorsement shall be effective until the tenth day following the mailing (by certified or registered mail return receipt requested) of written notices of such cancellation to the Architect and to the Owner.

E. ONE YEAR WARRANTY:

General Contractor warrants to the Owner that all materials and equipment furnished under this contract will be new unless otherwise specified, and that all work will be of good quality, free from faults and defects and in conformance to the requirements, including substitutions not properly approved and authorized, which may be considered defective. The warranty shall extend for ONE (1) year after the Substantial Completion date or portions thereof. Certain materials and components which have manufacturer’s and/or installer warranties, which may be longer than one year, shall not be limited by the General Contractor’s general warranty.

O. ALLOWANCES:

Contractor shall indicate to the Architect any impact on the Contract time that any work in an Allowance item may have. And shall request in a timely manner additional information necessary to schedule, coordinate, and complete work required by an Allowance item.

P. REVIEW OF DOCUMENTS:

The Contractor shall not be liable to the Owner or Architect for damages resulting from errors or omissions in the Contract Documents unless the Contractor recognized such error or omission and failed to report it to the Architect.

**END OF SECTION 000800**

## SECTION 001010 - SUMMARY OF WORK

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 PROJECT DESCRIPTION

- A. The work includes construction for the ***Interior Office Remodel for The Arc of the Ozarks***, at 500 NE Colbern Road, Lee’s Summit, Missouri as described in the drawings and specifications.
- B. Contractor shall take any and all means necessary to ensure completion by the contracted date of Substantial Completion, including overtime, weekend work, multiple shifts, additional work force, etc.

#### 1.3 OWNER INITIATED WORK

- A. Owner will install data and telephone cable, intrusion alarm system, and office/dental equipment in concert with the work, prior to close-in of concealed spaces. Coordinate with Owner.
- B. Cooperate and coordinate with Owner and Owner’s Contractor’s for installation of miscellaneous equipment and furnishings, subject to agreement, regarding insurance, security and liability.
- C. Schedule of Work by Owner: (To be completed by Owner’s forces or separate Contracts)
  - 1. Data and Communications cable and jacks, Computer equipment and telephone hand-sets.
  - 2. Telephone / data communications service and wiring.
  - 3. Interior signage. Other than that indicated in Section 10990 and as may be shown on the drawings to be included in the Contract.
  - 4. Projection screens, marker boards, tack boards, sound systems which may be required and all moveable furniture and equipment.
  - 5. Intrusion, detection and alarm systems, security cameras, entry monitoring devices, etc.
  - 6. Security and control devices.
  - 7. Window blinds and treatments other than that shown in the Contract Documents.
  - 8. Kitchen appliances. (Unless noted on Drawings)
  - 9. Office equipment / Office Furniture as indicated on the Drawings as Owner provided.

- D. Coordinate and cooperate with work by **The City of Lee’s Summitt, Missouri** and with work being done under separate contract by **the Arc of the Ozarks and/or their vendors**.

#### 1.4 CONTRACTOR USE OF PREMISES

- A. Contractor shall coordinate with Owner for location of specific areas for parking, materials storage, loading, etc.; all trades shall conform to defined use areas and shall not unreasonably or unnecessarily encumber or use other areas of the site.
  - 1. Site must be maintained free of trash and construction debris and cleaned everyday. Provide containers for use by workmen.
  - 2. Contractor shall provide for secure storage of material via trailers or fenced enclosures.
  - 3. Contractor shall provide for general security of work areas by fencing, posted entries and lighting as may be necessary.
  - 4. Contractor shall take measures to control soil erosion and silt migration by use of silt fences, hay bales, swales, detention, etc.
  - 5. Traffic Control: Contractor shall install temporary construction entrance, and take all necessary measures to ensure safe entry and exit, including signs, flagmen, coordination with the Owner, City and other measures as required.
  - 6. All waste materials shall be disposed of off-site - burning is not permitted on Owner’s property.
- B. Union and Non-Union: Contractor shall take measures as necessary to avoid conflicts between union and non-Union laborers, including separate entrances, or other agreements/arrangements as may be necessary.

#### 1.5 BOUNDARIES AND BENCHMARKS

- A. Contractor shall employ a professional Civil Engineer or Land Surveyor registered in the State of Missouri, and approved by the Architect, to confirm or define site boundaries and for layout of building lines. Erect substantial benchmarks and preserve them throughout the work.

#### 1.6 UNANTICIPATED CONDITIONS

- A. If in the course of work the Contractor anticipates and/or discovers conditions and/or materials which are beyond the scope of this contract, and/or which may be deemed unreasonably hazardous, and/or uncovers materials which are legally defined as hazardous, the Contractor is to stop work in the area affected, immediately inform the Architect, and do not proceed until resolved in writing from the Architect.
- B. The Contractor shall make every reasonable effort to inspect for unanticipated conditions, and to anticipate such conditions by prudent project planning and coordination.

### 1.7 ASBESTOS

- A. No products shall be installed in this project which contain asbestos in any of its various forms. If so requested by the owner, the Contractor shall submit to the Owner upon completion of the project (see Section 01700) certification in writing that no products contain asbestos. If any supplier or subcontractor has knowledge or access to knowledge that any specified product herein contains asbestos, they shall immediately inform the General Contractor and the Architect prior to submission of bids.

### 1.8 SMOKING AND ALCOHOL POLICY

- A. Smoking or use of tobacco products will **not** be allowed in the building. Contractor may designate a specific smoking area away from the building with approval by Owner and provide for disposal of smoking or tobacco residues.
- B. Alcoholic products will **not** be allowed on site **any** time.

### 1.8 SUPERINTENDENT

- A. The Contractor shall employ a full-time on-site Project Superintendent assigned full time to this project. Superintendent shall be experienced and qualified in projects of similar size and scope; the Owner reserves the right to reject the proposed Superintendent.
- B. The Superintendent shall remain with the project until final completion and shall not be replaced with another individual or reassigned to another project except as may be agreed to or approval by the Owner.

### 1.9 LOCATIONS AND INTERFERENCES

- A. Locations of equipment and other work is indicated diagrammatically by drawings. Determine exact locations on job, subject to structural conditions, work of other Contractors, access requirements of installation and maintenance and to approval of A/E. Provide necessary material and labor as needed to coordinate with other work and as needed for complete operational system, and other components of which not all may be exactly shown on the drawings.
- B. Study and become familiar with contract drawings of other trades and in particular the general construction plans and details to obtain necessary information for figuring installation. Cooperate with other workmen and install work to avoid interference with their work. Minor deviations, not affecting design characteristics, performance or space limitations may be permitted if reviewed by A/E prior to installation.

- C. Installation of any pipe, apparatus, appliance or other item which interferes with proper placement of other work as indicated on drawings, specified, or required, shall be removed, relocated and reconnected, without cause for change in the contract amount. Coordination of trades is the responsibility of the General Contractor. See General Conditions for additional coordination responsibilities.
- D. Drawings are not be scaled. Dimensional data shall be obtained from written information only. Verify all dimensions before proceeding, any dimensional deviation from that shown on drawings, which may affect intent of design or proper incorporation of elements shall be brought to Architect’s attention promptly and resolution obtained before proceeding. Dimensions indicated in contract documents are from face of stud to face of stud, face of existing structure, or finish, face of concrete or block, or structural line, except as noted otherwise. Dimensions of existing structure, or conditions, etc. are plus or minus and should be field verified prior to commencement of work and Architect notified of any discrepancies.

#### 1.10 MINIMUM REQUIREMENTS AND STANDARDS

- A. It is the intent of this Contract that a completed and fully operational product be delivered by the Contractor as required by the General Conditions. It is the intent of the documents for all indicated equipment and components to be powered, connected, attached, supported, piped, wired, and otherwise functional as necessary to meet manufacturer's recommended installation requirements, and industry standards. The documents are not intended to necessarily show detailed fabrication and installation instructions, nor to show every distinct part and component and their exact location.
- B. Minimum Standards: Where supportive details and components are not specifically indicated, but required for a complete and proper installation, the Contractor shall refer to the manufacturer's recommendations and installation instructions, and to industry standards for installation of the component or system. See Section 01095 Reference Standards and Definitions.

#### 1.11 WARRANTIES

- A. General Contractor shall provide a one year unlimited warranty against defects in workmanship and materials, as well as minor adjustments to components of the work, in addition to product warranties provided by manufacturers of individual components. The contractor's warranty shall include labor and material and other incidental costs as necessary to correct any defects. All warranties shall commence at date of Substantial Completion. (See Supplemental General Conditions also).

#### 1.12 GEO-TECHNICAL REPORT

- A. A geo-technical report for this project **is not available/not required for this project.**



**END OF SECTION 001010**

## **SECTION 010270 - APPLICATIONS FOR PAYMENT**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.

#### **1.3 SCHEDULE OF VALUES**

- A. Coordinate preparation of the Schedule of Values with preparation of the Contractor's Construction Schedule.
  - 1. Submit the Schedule of Values to the Architect at the earliest feasible date, but in no case later than 7 days before the date scheduled for submittal of the initial Application for Payment.
- B. Format and Content: Use the Project Manual Table of Contents as a guide to establish the format for the Schedule of Values.
  - 1. Identification: Include the following Project identification on the Schedule of Values:
    - a. Project name and location.
    - b. Name of the Architect.
    - c. Project number.
    - d. Contractor's name and address.
    - e. Date of submittal.
  - 2. Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed:
    - a. Generic name.
    - b. Related Specification Section.
    - c. Name of subcontractor.
    - d. Name of manufacturer or fabricator.
    - e. Name of supplier.
    - f. Change Orders (numbers) that have affected value.

- g. Dollar value.
  - h. Percentage of Contract Sum to the nearest one-hundredth percent, adjusted to total 100 percent.
- 3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items.
- 4. Round amounts off to the nearest whole dollar; the total shall equal the Contract Sum.
- 5. Margins of Cost: Show line items for indirect costs, and margins on actual costs, only to the extent that such items will be listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete including its total cost and proportionate share of general overhead and profit margin.
  - a. At the Contractor’s option, temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown as separate line items in the Schedule of Values or distributed as general overhead expense.
- 6. Schedule Updating: Update and resubmit the Schedule of Values when Change Orders or Construction Change Directives result in a change in the Contract Sum.

#### 1.4 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by the Architect and paid for by the Owner.
  - 1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is the 15th day of each month. The period of construction Work covered by each Application for Payment is the period ending 15 days prior to the date for each progress payment and starting the day following the end of the preceding period. The Contractor shall submit the Application for payment by the 5th day of each month preceding the requested payment.
- C. Payment Application Forms: Use AIA Document G 702 and Continuation Sheets G 703 as the form for Application for Payment.
- D. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Owner. Incomplete applications will be returned without action.
  - 1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.
  - 2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.

- E. Transmittal: Submit 4 executed copies of each Application for Payment to the Architect by means ensuring receipt within 24 hours; one copy shall be complete, including waivers of lien and similar attachments, when required.
  - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information related to the application in a manner acceptable to the Architect.
- F. Waivers of Mechanics Lien: With each Application for Payment submit waivers of mechanics liens from subcontractors or sub- subcontractors and suppliers for the construction period covered by the previous application.
  - 1. Submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.
  - 2. When an application shows completion of an item, submit final or full waivers.
  - 3. The Owner reserves the right to designate which entities involved in the Work must submit waivers.
  - 4. Waiver Forms: Submit waivers of lien on forms, and executed in a manner, acceptable to Owner.
- G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include the following:
  - 1. List of subcontractors
  - 2. List of principal suppliers and fabricators.
  - 3. Schedule of Values.
  - 4. Schedule of unit prices.
  - 5. Certificates of insurance and insurance policies.
- H. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work. See Section 01700 for limitation of number of inspections and related pay applications.
- I. Administrative actions and submittals that shall proceed or coincide with this application include:
  - 1. Warranties (guarantees) and maintenance agreements.
  - 2. Maintenance instructions.
  - 3. Application for reduction of retainage.
  - 4. Advice on shifting insurance coverage.
  - 5. List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion.
- J. Final Payment Application: Administrative actions and submittals which must precede or coincide

with submittal of the final payment Application for Payment include the following:

1. Completion of Project closeout requirements.
2. Completion of items specified for completion after Substantial Completion.
3. Assurance that unsettled claims will be settled.
4. Assurance that Work not complete and accepted will be completed without undue delay.
5. Transmittal of required Project construction records to Owner.
6. Removal of temporary facilities and services.
7. Removal of surplus materials, rubbish and similar elements.
8. See Section 01700 for limitations to number of inspections and therefore pay applications.
9. See Supplemental General Conditions and Section 01700 for additional limitations to pay applications and release of retainage.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

**END OF SECTION 010270**

## **SECTION 010350 - MODIFICATION PROCEDURES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This section specifies administrative and procedural requirements for handling and processing Contract modifications.
  - 1. Division 1 Section "Unit Prices" for administrative requirements governing use of unit prices.
  - 2. Division 1 Section "Application for Payment" for administrative procedures governing applications for payment.
  - 3. Division 1 Section "Product Substitutions" for administrative procedures for handling requests for substitutions made after award of the Contract.

#### **1.3 MINOR CHANGES IN THE WORK**

- A. Supplemental instructions authorizing minor changes in the Work, not involving an adjustment to the Contract Sum or Contract Time, will be issued by the Architect on AIA form G710, Architect's Supplemental Instructions.

#### **1.4 CHANGE ORDER PROPOSAL REQUESTS**

- A. Owner-Initiated Proposal Requests: Proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time will be issued by the Architect, with a detailed description of the proposed change and supplemental or revised Drawings and Specifications, if necessary.
  - 1. Proposal requests issued by the Architect are for information only. Do not consider an them instruction either to stop work in progress, or to execute the proposed change.
  - 2. Unless otherwise indicated in the proposal request, within 7 days of receipt of the proposal request, submit to the Architect for the Owner's review an estimate of cost necessary to execute the proposed change.
    - a. Include a list of quantities of products to be purchased and unit costs, along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.

- b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
  - c. Include a statement indicating the effect the proposed change in the Work will have on the Contract Time.
- B. Contractor-Initiated Change Order Proposal Requests: When latent or other unforeseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Architect.
  - 1. Include a statement outlining the reasons for the change and the effect of the change on the Work within 10 days of occurrence of cause for change. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.
  - 2. Include a list of quantities of products to be purchased and unit costs along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
  - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
  - 4. Comply with requirements in Section "Product Substitutions" if the proposed change in the Work requires the substitution of one product or system for a product or system specified.
- C. Proposal Request Form: Use AIA Document G 709 for Change Order Proposal Requests.

#### 1.5 UNIT COST ALLOWANCES

- A. Allowance Adjustment: Base each Change Order Proposal Request for an allowance cost adjustment solely on the difference between the actual purchase amount and the unit cost allowance, multiplied by the final measurement of work-in-place, with reasonable allowances, where applicable, for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
  - 1. Submit substantiation of a change in scope of work claimed in the Change Orders related to unit-cost allowances.
  - 2. The Owner reserves the right to establish the actual quantity of work-in-place by independent quantity survey, measure, or count.
- B. Submit claims for increased costs because of a change in scope or nature of the unit cost allowance described in the Contract Documents within 20 days of receipt of the change order or construction change directive authorizing work to proceed.
  - 1. The Change Order cost amount shall not include the Contractor's or Subcontractor's indirect expense except when it is clearly demonstrated that either the nature or scope of work required was changed from that which could have been foreseen from the description of the allowance and other information in Contract Documents.
  - 2. No change to the Contractor's indirect expense is permitted for selection of higher or lower priced materials or systems of the same scope and nature as originally indicated.

## 1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: When the Owner and Contractor are not in total agreement on the terms of a Change Order Proposal Request, the Architect may issue a Construction Change Directive on AIA Form G714, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
  - 1. The Construction Change Directive will contain a complete description of the change in the Work and designate the method to be followed to determine change in the Contract Sum or Contract Time.
  - 2. Requirements listed below for Change Orders apply to Construction Change Directives in determining changes to the Contract Sum or Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
  - 1. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

## 1.7 CHANGE ORDER PROCEDURES

- A. Upon the Owner's approval of a Change Order Proposal Request, the Architect will issue a Change Order for signatures of the Owner and Contractor on AIA Form G701, as provided in the Conditions of the Contract.
- B. Submit a complete itemized list of all material and labor in each proposal for change items as shown by example of attached sample itemized proposal.
- C. Deductive Change Orders shall include percentages for overhead and profit.

## 1.8 MAXIMUM ALLOWANCE FOR OVERHEAD AND PROFIT & LABOR BURDEN

- A. Labor costs per hour shall be included with labor burden identified, which shall not be less than the prevailing wage rate, or actual labor rate, etc. Identify any labor burden costs over and above the prevailing wage rate. Labor burden costs shall not include overhead and profit charges as identified below. In no case shall labor burden costs exceed 15% of the wage rate.
- B. The overhead and profit charge by the Contractor and all subcontractors shall be considered to include, but is not limited to: performance/payment bond, job site office expense, incidental job burdens, truck expense including mileage, small hand tools, project supervision including field supervision, company benefits and general office overhead. Percentages for overhead and profit



charged for Change Orders shall be negotiable and may vary according to the nature, extent and complexity of the work involved. Percentage mark ups provided herein are intended to include the costs associated with all delay, disruption, extended job site presence and home office overhead resulting from the changed work.

C. The maximum Overhead and Profit shall be as follows:

1. For the Contractor, for work performed by the Contractors' own forces, 10% of the cost, including bond.
2. For the Contractor, for work performed by Subcontractors, 10% of amount due the subcontractor.
3. For each Subcontractor or Sub-Subcontractor, a maximum of 10% over direct cost from the supplier for materials.
4. For each Subcontractor, for work by his sub-subcontractor, 10% of the amount due the sub-subcontractor.
5. Overhead and Profit shall be shown separately for each subcontractor and the Contractor.

D. On proposals covering both increases and decreases in the amount of this contract, the application of overhead and profit shall be on the net change in the cost of the work. Proposals must show items to be deleted, if any, and the cost of the change shall be the result of the net difference to the base contract. Proposals are **not** to be determined by a re-bid of the entire scope of work except where changes significantly alter the entire scope of a particular trade.

E. The percentages for overhead and profit credit to the Owner on Change Orders that are solely decreases in the quantity of work or materials may be negotiated and may vary according to the nature, extent and complexity of the work involved, but in no case shall be less than ten percent (10%).

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

**END OF SECTION 010350**

## SECTION 010400 - COORDINATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes administrative and supervisory requirements necessary for coordinating construction operations including, but not necessarily limited to, the following:
  - 1. Coordination with Owner and Owner facility personnel.
  - 2. Coordination with personnel from **City of Lee’s Summit, MO**.
  - 3. Coordination with personnel from the Building Owner/Developer.
  - 4. Coordination with other contracts let by the Owner in connection with this work.

#### 1.3 COORDINATION

- A. Partnering: The Owner desires to create a partnering relationship with the Contractor, principal subcontractors, major suppliers and the Consultant. This relationship will be structured to draw on the strengths of each organization to identify and achieve reciprocal goals. The objectives are the effective and efficient contract performance and project completion within budget and schedule –all in accordance with the drawings and specifications.
- B. The Contractor shall coordinate construction operations for this project with the Construction Representative and facility personnel to assure efficient and orderly completion of the Work.
  - 1. Schedule construction operations in the sequence required to obtain the best results.
  - 2. Coordinate construction operations to allow existing facility to remain in operation while the Work is being performed.
  - 3. Coordinate construction operations to accommodate construction operations of other contracts let by the Owner.
- C. Administrative Procedures: The Contractor shall coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
  - 1. Preparation of schedules.
  - 2. Installation and removal of temporary facilities.

3. Delivery and processing of submittals.
4. Progress meetings.
5. Project closeout activities.

#### 1.4 SUBMITTALS

- A. Staff Names: Within ten (10) working days following the Notice to Proceed, the Contractor shall submit a list of the Contractor’s principal staff assignments, including the superintendent and other personnel in attendance at the Project Site. The list shall identify individuals, their duties, responsibilities, addresses and telephone numbers.
- B. Schedule: Within ten (10) working days following the Notice to Proceed, the Contractor shall submit a schedule which coordinates the construction activities of this work with the work of other contracts. See Division 01320-Schedules for specific requirements.

#### PART 2 - PRODUCTS (Not Applicable)

#### PART 3 - EXECUTION

##### 3.1 GENERAL COORDINATION PROVISIONS

- A. A pre-construction conference may be held prior to beginning of construction. The date, time and exact place of this meeting will be determined after contract award and notification of all interested parties. The Contractor shall arrange to have the job superintendent and all prime subcontractors present at the meeting. During the pre-construction conference, the construction procedures and information necessary for submitting payment requests will be discussed and materials distributed, along with any other pertinent information.
- B. Coordination drawings of the various trade work as applicable shall be executed prior to commencement of the work.

**END OF SECTION 010400**

## **SECTION 010450 - CUTTING AND PATCHING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section specifies administrative and procedural requirements for cutting and patching.
- B. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
  - 1. Requirements of this Section apply to mechanical and electrical installations. Refer to Division 15,16,31,32 and 33 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

#### **1.3 SUBMITTALS**

- A. Cutting and Patching Proposal: Where approval of procedures for cutting and patching is required before proceeding, submit a proposal describing procedures well in advance of the time cutting and patching will be performed and request approval to proceed. Include the following information, as applicable, in the proposal:
  - 1. Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.
  - 2. Describe anticipated results in terms of changes to existing construction; include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.
  - 3. List products to be used and firms or entities that will perform Work.
  - 4. Indicate dates when cutting and patching is to be performed.
  - 5. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.
  - 6. Where cutting and patching involves addition of reinforcement to structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.
  - 7. Approval by the Architect to proceed with cutting and patching does not waive the Architect's right to later require complete removal and replacement of a part of the Work found to be unsatisfactory.

## 1.4 QUALITY ASSURANCE

- A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load-carrying capacity or load-deflection ratio.
  - 1. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements:
    - a. Foundation construction.
    - b. Bearing and retaining walls.
    - c. Structural concrete.
    - d. Structural steel.
    - e. Lintels.
    - f. Structural decking.
    - g. Miscellaneous structural metals.
    - h. Equipment supports.
    - i. Piping, ductwork, vessels and equipment.
- B. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety.
  - 1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems:
    - a. Shoring, bracing, and sheeting.
    - b. Primary operational systems and equipment.
    - c. Air or smoke barriers.
    - d. Water, moisture, or vapor barriers.
    - e. Membranes and flashings.
    - f. Fire protection systems.
    - g. Noise and vibration control elements and systems.
    - h. Control systems.
    - i. Communication systems.
    - j. Electrical wiring systems.
- C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Architect's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually unsatisfactory manner.
  - 1. If possible retain the original installer or fabricator to cut and patch the following categories of

exposed Work, or if it is not possible to engage the original installer or fabricator, engage another recognized experienced and specialized firm:

- a. Processed concrete finishes.
- b. Stonework and stone masonry.
- c. Ornamental metal.
- d. Matched-veneer woodwork.
- e. Aluminum Wall Panel System.
- f. Window wall system.
- g. Exterior Finish and Insulation System.
- h. Acoustical ceilings.
- i. Tile Flooring
- j. Carpeting.
- k. Wall covering.
- l. HVAC enclosures, cabinets or covers.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Use materials whose installed performance will equal or surpass that of existing materials.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.

### 3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.

- C. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Take all precautions necessary to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

### 3.3 PERFORMANCE

- A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
  - 1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.
- B. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original installer's recommendations.
  - 1. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  - 2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
  - 3. Cut through concrete and masonry using a cutting machine such as a carborundum saw or diamond core drill.
  - 4. Comply with requirements of applicable Sections of Division-2 where cutting and patching requires excavating and backfilling.
  - 5. By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed, relocated or abandoned. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.
- C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
  - 1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
  - 2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
  - 3. Where removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary to achieve uniform color and appearance.
    - a. Where patching occurs in a smooth painted surface, extend final paint coat over entire unbroken containing the patch, after the patched area has received primer and second coat.

4. Patch, repair or rehang existing ceilings as necessary to provide an even plane surface of uniform appearance.

#### 3.4 CLEANING

- A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

**END OF SECTION 010450**



## **SECTION 010950 - REFERENCE STANDARDS AND DEFINITIONS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 DEFINITIONS**

- A. General: Basic Contract definitions are included in the General Conditions.
- B. Indicated: The term "indicated" refers to graphic representations, notes, or schedules on the Drawings, other paragraphs or schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help the reader locate the reference; no limitation on location is intended.
- C. Approve: The term "approved" shall mean "no exception taken" in so far as the Architect's determination that submittals or work is observed to be in general compliance with the Contract. "Approval" does not relieve the Contractor of his duties to fulfill the contract.
- D. Regulation: The term "Regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
- E. Furnish: The term "furnish" is used to mean "supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations."
- F. Install: The term "install" is used to describe operations at project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations."
- G. Provide: The term "provide" means "to furnish and install, complete and ready for the intended use."
- H. "Equal" shall mean reasonably and/or exactly identical to or better. The Architect shall be the sole judge of compliance to this definition, in regard to submittals, substitutions, and work performed and proposed.
- I. "Similar to" shall mean the same as equal.
- J. Project Site is the space available to the Contractor for performance of construction activities, either exclusively or in conjunction with others performing other work as part of the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land upon which the Project is to be built.

#### **1.3 SPECIFICATION FORMAT AND CONTENT EXPLANATION**

- A. Specification Format: These Specifications are organized into Divisions and Sections based on the MASTER FORMAT numbering system.
- B. Specification Content: This Specification uses certain conventions in the use of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:
  - 1. Abbreviated Language: Language used in Specifications and other Contract Documents is the abbreviated type. Implied words and meanings will be appropriately interpreted. Singular words will be interpreted as plural and plural words interpreted as singular where applicable and the full context of the Contract Documents so indicates.
    - a. The words "shall be" shall be included by inference wherever a colon (:) is used within a sentence or phrase.
- C. Products and Manufacturer’s Listings: (See 016000 also)
  - 1. Where one or more products is named and without reference to an equal one of those products shall be supplied unless a substitute is approved by the Architect by written addendum or other contract modification procedure.
  - 2. Where one or more products is named and associated with the phrases “or approved equal”, or “or equal”, “...similar to...”, or similar language, the Contractor may substitute equal products by another manufacturer. See above for definition of equal. Any risks associated with the Architect making a judgement of “not equal” are the responsibility of the Contractor. Pre-bid requests and review are recommended, see Substitutions 012500.
  - 3. Where one or more named products is not available or conflicts with a model no. or performance requirement, or is otherwise ambiguous or unclear, the Contractor shall inform the Architect prior to bidding for a clarification by addendum.
- D. Performance Requirements: (See 016000 also)
  - 1. Where a specific product is not named, and instead performance requirements and design criteria are indicated, the Contractor may submit a product which meets or exceeds such requirements.
  - 2. Where performance criteria is indicated in addition to a named product, both requirements shall be met, or the more specific, stringent, or higher value, criteria shall be met. Any conflicts or ambiguities shall be reported to the Architect for clarification by pre-bid addendum.

#### 1.4 INDUSTRY STANDARDS

- A. Publication Dates: Where the date of issue of a referenced standard is not specified, comply with the standard in effect as of date of Contract Documents.
- B. Conflicting Requirements: ***Where compliance with two or more standards is specified, and the standards establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirements will be enforced unless specifically indicated in writing as a clarification or Addendum by the Architect.*** Requirements that are different, but apparently equal,

and other uncertainties shall be referred to the Architect for a decision before proceeding.

1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. In complying with these requirements, indicated numeric values are minimum or maximum, as appropriate for the context of the requirements. Refer uncertainties to the Architect for a decision before proceeding.
- C. Copies of Standards: Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to that entity's construction activity. Copies of applicable standards are not bound with the Contract Documents.
  1. Where copies of standards are needed for performance of a required construction activity, the Contractor shall obtain copies directly from the publication source.
- D. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where such acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards generating organization, authority having jurisdiction, or other entity applicable to the context of the text provision. Refer to the "Encyclopedia of Associations," published by Gale Research Co., available in most libraries.

#### 1.5 GOVERNING REGULATIONS/AUTHORITIES

- A. The Architect has contacted authorities having jurisdiction where necessary to obtain information necessary for preparation of Contract Documents; that information may or may not be of significance to the Contractor. Contact authorities having jurisdiction directly for information and decisions having a bearing on the Work.

#### 1.6 SUBMITTALS

- A. Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence, and records established in conjunction with compliance with standards and regulations bearing upon performance of the Work.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

**END OF SECTION 010950**

## **SECTION 012000 - PROJECT MEETINGS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section specifies administrative and procedural requirements for project meetings including but not limited to:
  - 1. Pre-Construction Conference.
  - 2. Progress Meetings.
  - 3. Pre-Installation Meeting.
- B. Construction schedules are specified in another Division-1 Section.

#### **1.3 PRE-CONSTRUCTION CONFERENCE**

- A. Schedule a pre-construction conference and organizational meeting at the Project site or other convenient location no later than 15 days after execution of the Agreement and prior to commencement of construction activities. Conduct the meeting to review responsibilities and personnel assignments.
- B. Attendees: The Owner, Architect and their consultants, the Contractor and its superintendent, major subcontractors, manufacturers, suppliers and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the Work.
- C. Agenda: Discuss items of significance that could affect progress including such topics as:
  - 1. Tentative construction schedule.
  - 2. Procedures for processing field decisions and Change Orders.
  - 3. Procedures for processing Applications for Payment.
  - 4. Distribution of Contract Documents.
  - 5. Submittal of Shop Drawings, Product Data and Samples.
  - 6. Preparation of record documents.
  - 7. Use of the premises.
  - 8. Office, Work and storage areas.

9. Equipment deliveries and priorities.
10. Safety procedures.
11. First aid.
12. Security.
13. Housekeeping.
14. Working hours.

#### 1.4 PROGRESS MEETINGS

- A. Conduct progress meetings at the Project site at regularly scheduled intervals. Notify the Owner and Architect of scheduled meeting dates in advance. Coordinate dates of meetings with preparation of the payment request.
- B. Attendees: In addition to representatives of the Owner and Architect, each subcontractor, supplier or other entity concerned with current progress or involved in planning, coordination or performance of future activities shall be represented at these meetings by persons familiar with the Project and authorized to conclude matters relating to progress.
- C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.
  1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
  2. Review the present and future needs of each entity present, including such items as:
    - a. Time.
    - b. Sequences.
    - c. Deliveries.
    - d. Off-site fabrication problems.
    - e. Access.
    - f. Temporary facilities and services.
    - g. Hazards and risks.
    - h. Housekeeping.
    - i. Quality and Work standards.
    - j. Change Orders.
    - k. Documentation of information for payment requests.
- D. Reporting: No later than 3 days after each progress meeting date, distribute copies of minutes of the meeting to each party present and to other parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.

1. Schedule Updating: Revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule concurrently with the report of each meeting.

#### 1.5 PRE-INSTALLATION MEETING

- A. Prior to installation of following items, schedule a meeting with minimum of seven (7) days written notice to all participants. Notify Architect and Owner in writing a minimum of seven (7) business days prior to installation of the following items:
  1. Concrete work.
  2. Roofing
  3. Masonry
  4. Carpet.
  5. Tile.
  6. Ceiling systems
  7. Studs and drywall.
  8. Underslab Plumbing
  9. Electrical work.
  10. HVAC Systems
  11. Specialty Painting
- B. Agenda
  1. Review of specification requirements.
  2. Coordinative discussions between subcontracting groups.
  3. Scheduling.
  4. Deliveries.
  5. Surface protection during concrete during time required prior to floor coating installation during and after coating installation.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

**END OF SECTION 012000**

## SECTION 012500 - SUBSTITUTION PROCEDURES

### PART 1 - GENERAL

#### 1.1 SUMMARY

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

#### 1.2 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

#### 1.3 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 Attached Substitution Request Form at the end of this Section.***
  - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
    - b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
    - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. 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, if requested.
  - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
  - i. Cost information, including a proposal of change, if any, in the Contract Sum.
  - j. 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.
  - k. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
- 3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 10 business 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.

#### 1.4 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.

### 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:
    - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    - b. Requested substitution will not adversely affect Contractor's construction schedule.
    - c. Requested substitution has received necessary approvals of authorities having jurisdiction.
    - d. Requested substitution is compatible with other portions of the Work.
    - e. Requested substitution has been coordinated with other portions of the Work.



- f. Requested substitution provides specified warranty.
  - g. 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 30 days after the Notice to Proceed.
  - 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied:
    - a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
    - b. Requested substitution does not require extensive revisions to the Contract Documents.
    - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
    - d. Requested substitution will not adversely affect Contractor's construction schedule.
    - e. Requested substitution has received necessary approvals of authorities having jurisdiction.
    - f. Requested substitution is compatible with other portions of the Work.
    - g. Requested substitution has been coordinated with other portions of the Work.
    - h. Requested substitution provides specified warranty.
    - i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION (Not Used)

**END OF SECTION 012500**

# SUBSTITUTION REQUEST FORM

**MAIL TO:** Buxton Kubik Dodd Design Collective    **PROJECT:** Interior Office Renovation for:  
3100 S. National Ave., Suite 300    The Arc of the Ozarks  
Springfield, Missouri 65807    500 NE Colbern Road  
Email: [jdodd@bk-dc.com](mailto:jdodd@bk-dc.com)    Lee's Summit, Missouri 64086

**SPECIFIED  
ITEM:** \_\_\_\_\_

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

**SUBMITTED BY:**

Firm: \_\_\_\_\_

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

Signature: \_\_\_\_\_

Date: \_\_\_\_\_ Phone No. \_\_\_\_\_

Attach complete description, designation, catalog or model number, Spec Data Sheet and other Technical Data, including Laboratory Tests if Applicable.

*Fill in blanks below:*

1. Will substitution affect dimension indicated on drawings?  
\_\_\_\_\_
2. Will substitution affect wiring, piping, ductwork, etc., indicated on drawings?  
\_\_\_\_\_
3. What effect will substitution have on other trades?  
\_\_\_\_\_
4. Differences between proposed substitution and specified item?  
\_\_\_\_\_
5. Any and all impacts on costs, design modifications, additional architectural and engineering services, material and labor changes, schedule changes, and other unanticipated consequences, resulting from this substitution in lieu of the specified item, shall be the full responsibility of the contractor and his subcontractors and supplier.
6. Manufacturer's warranties of the specified items and proposed items are: [ ] same [ ] different, *explain:*  
\_\_\_\_\_

**REVIEW COMMENTS:**

- [ ] **No Exception taken to Submitted Manufacturer**  
*Manufacturer only is accepted due to time limitations for full review of product, or because no specific product data is submitted, or other unspecified reasons. Contractor must still bear full responsibility for compliance with contract requirements.*
- [ ] **No Exception taken to Specific Products**
- [ ] **Exceptions Noted**  
*See attached copy or notes on product literature*
- [ ] **Not Accepted**
- [ ] **Received too Late**

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

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

## SECTION 013000 - SUBMITTALS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for submittals required for performance of the Work, including;
  - 1. Contractor's construction schedule.
  - 2. Daily construction reports.
  - 3. Shop Drawings.
  - 4. Product Data.
  - 5. Samples.
  - 6. Color Selection Packages
  - 7. ***Electronic (pdf) submittals are preferred/encouraged.***
- B. Administrative Submittals: Refer to other Division-1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to:
  - 1. Applications for payment.
  - 2. Insurance certificates.
  - 3. List of Subcontractors.
- C. The Schedule of Values submittal is included in Section "Applications for Payment."
- D. Inspection and test reports are included in Section "Quality Control Services."
- E. Copies: Minimum Required. A/E will retain a minimum of 2 copies - provide minimum plus number of additional copies required by General Contractor.
  - 1. Drawings: Provide 1 (one) reproducible and 4 (four) copies.
  - 2. Product Data: Provide 6 (six) copies.
  - 3. Samples: Provide (2) two sets.
- F. Review Time:
  - 1. Allow a maximum of **three (3) weeks** from receipt of complete and final submission for return of same. Resubmittals shall allow **two (2) weeks** for review and return.
  - 2. The Architect will make every effort to expedite reviews and will return submittals as soon as reasonably possible. However, the Contractor shall not base construction schedules upon anything less than a 3 week submittal review period.
  - 3. Special conferences can be arranged upon request in order to expedite a submittal due to circumstances beyond control of the Contractor, and when agreed to by the Architect as reasonable and necessary.
- G. Contractor's Stamp: All shop drawings and submittals shall bear the General Contractor's review

stamp, dated and initialed, before being submitted to the Architect.

H. Fabrication Stamps:

1. **DO NOT submit shop drawings and submittals stamped “FOR REVIEW ONLY” or “NOT FOR CONSTRUCTION”**, or similar notations which imply a second review is required.
2. Architect’s review and stamp is only for documents which are to be used in the field for construction. “Review only” sets require a second submittal and complete re-review. Second reviews of this nature will be back charged to the Contractor.

I. The Contractor bears responsibility for informing the Architect of any submittals and/or products data which deviate from the contract requirements and specifications. Deviations must be clearly indicated and the reasons for the deviations reported in writing. Any costs related to any deviations whether accepted or not shall be the Contractor’s responsibility.

J. Contract Modification: Return of reviewed shop drawings and submittals DOES NOT CONSTITUTE AN AUTHORIZED CONTRACT MODIFICATION OR CHANGE. Failure to fully comply with the contract requirements and specifications is not waived by review of submittals. (See General Conditions of the Contract).

### 1.3 SUBMITTAL PROCEDURES

A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
  - a. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received and will inform Contractor of such requirement.
3. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for re-submittals.
  - a. Allow three (3) weeks for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Architect will promptly advise the Contractor when a submittal being processed must be delayed for coordination.
  - b. If an intermediate submittal is necessary, process the same as the initial submittal.
  - c. Allow two (2) weeks for reprocessing each submittal.
  - d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.

B. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.

1. Provide a space approximately 4" x 5" on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.
2. Include the following information on the label for processing and recording action taken.
  - a. Project name.
  - b. Date.
  - c. Name and address of Architect.

- d. Name and address of Contractor.
  - e. Name and address of subcontractor.
  - f. Name and address of supplier.
  - g. Name of manufacturer.
  - h. Number and title of appropriate Specification Section.
  - i. Drawing number and detail references, as appropriate.
- C. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Architect using a transmittal form. Submittals received from sources other than the Contractor will be returned without action.

#### 1.4 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Prepare a fully developed, horizontal bar- chart type Contractor's construction schedule. Submit within 30 days of the date established for "Commencement of the Work".
- 1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units as indicated in the "Schedule of Values".
  - 2. Coordinate the Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests and other schedules.
  - 3. Within each time bar, indicate estimated completion percentage in ten (10%) percent increments. As work progresses, place a contrasting mark in each bar to indicate actual completion.
- B. Schedule Updating: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

#### 1.5 FIELD DOCUMENTS

- A. Only shop drawings and submittals which have Architect's and General Contractor's (or Design Builder's) review stamps marked for release/review (see Paragraph 1.9) shall be used for fabrication, ordering, and for field installations.

#### 1.6 SHOP DRAWINGS

- A. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings. Shop drawings marked "Not for Construction" or "For Approval Only" or other disclaimer type marks or notations by the supplier, subcontractor, manufacturers or contractor shall be rejected and returned for re-submittal.
- B. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include the following information:
- 1. Dimensions.
  - 2. Identification of products and materials included.
  - 3. Compliance with specified standards.
  - 4. Notation of coordination requirements.

5. Notation of dimensions established by field measurement.
6. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2" x 11" but no larger than 36" x 48".
7. Submittal: Submit one correctable translucent reproducible print and four blue- or black-line prints for the Architect's review; the reproducible print will be returned.
  - a. One of the prints returned shall be marked-up and maintained as a "Record Document".
8. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.
9. Include General Contractor's review stamp with initials and date of review.

#### 1.7 PRODUCT DATA

- A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as "Shop Drawings."
  1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:
    - a. Manufacturer's printed recommendations.
    - b. Compliance with recognized trade association standards.
    - c. Compliance with recognized testing agency standards.
    - d. Notation of dimensions verified by field measurement.
  2. Submittals: Submit five (5) copies of each required submittal; submit 6 copies where required for maintenance manuals. The Architect will retain a minimum of three (3), and will return the other marked with action taken and corrections or modifications required.
    - a. Do not permit use of unmarked copies of Product Data in connection with construction.
  3. Include General Contractor's review stamp with initials and date of review.

#### 1.8 SAMPLES

- A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture and pattern.
  1. Where variation in color, pattern, texture or other characteristics are inherent in the material or product represented, submit multiple units (not less than 3), that show approximate limits of the variations.
  2. Submit minimum of two (2) samples of each submittal (Architect will retain a minimum of two of the actual samples).

#### 1.9 DAILY CONSTRUCTION REPORTS

- A. Prepare a daily construction report, recording the following information concerning events at the site; and submit duplicate copies to the Architect at weekly intervals:
  1. List of subcontractors at the site.
  2. Approximate count of personnel at the site.

3. High and low temperatures, general weather conditions.
4. Accidents and unusual events.
5. Meetings and significant decisions.
6. Stoppages, delays, shortages, losses.
7. Orders and requests of governing authorities.
8. Change Orders received, implemented.
9. Services connected, disconnected.
10. Partial Completions, occupancies.
11. Substantial Completions authorized.

#### 1.10 COLOR SUBMITTALS

- A. Submit all exterior products requiring a color selection at one time. Colors must be coordinated as a single package and requires Owner's review and approval. Missing submittals may be cause for delay in approval of all color selections:
  1. No extension of contract time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance to permit processing.
  1. Typical minimum exterior color package submittal:
    - Paints and special coatings
    - Window and storefront finishes
    - Prefinished metal products
    - Prefinished copings, flashings, etc.
    - Other siding materials, if applicable
    - Metal roofing
    - Light fixtures and electrical equipment
    - Other prefinished components, including plumbing, mechanical louvers, etc.

#### 1.11 ARCHITECT'S ACTION

- A. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Architect will review each submittal, mark to indicate action taken, and return promptly.
  1. Compliance with specified characteristics is the Contractor's responsibility.
- B. Action Stamp: The Architect will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:
  1. Final Unrestricted Release: Where submittals are marked "Reviewed," that part of the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.
  2. Final-But-Restricted Release: When submittals are marked "Make Corrections Noted," that part of the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.
  3. Returned for Resubmittal: When submittal is marked "Rejected, Revise and Resubmit, Submit Specified Item," do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a

different action mark.


- a. Do not permit submittals marked "Rejected, Revise and Resubmit, Submit Specified Item", or for unmarked submittals, to be used at the Project site, or elsewhere where Work is in progress.

C. See below a copy of the Architect’s submittal stamp.

PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION (Not Applicable).

**END OF SECTION 013000**

<input type="checkbox"/> REVIEWED FOR DESIGN CONFORMANCE <input type="checkbox"/> MAKE CORRECTIONS NOTED If checked above, fabrication MAY be undertaken.	
<input type="checkbox"/> REVISE AND RESUBMIT <input type="checkbox"/> SUBMIT SPECIFIED ITEM <input type="checkbox"/> REJECTED If checked above, fabrication MAY NOT be undertaken. Re-submission is required prior to final approval. Identify any changes made in addition to the items marked.	
This review is only for general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. Corrections or comments made on the shop drawings during this review do not relieve the Contractor from compliance with the requirements of the plans and specifications. Review and acceptance of a specified item does not mean approval of an assembly of which the item is a part. Contractor is responsible for: dimensions to be confirmed and correlated at the job site; information that pertains solely to the fabrication processes and the means, methods, techniques, sequences and procedures of construction; coordination of the work of all trades; and for performing all work in a safe and satisfactory manner.	
	<b>BUXTON KUBIK DODD</b> <b>DESIGN COLLECTIVE</b> 3100 S. National Avenue, Suite 300 Springfield, Missouri 65807 Voice: 417.890.5543    Fax: 417.890.5563
	CHECKED BY:  DATE:



## SECTION 014000 - QUALITY CONTROL SERVICES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for quality control services.
- B. The **Contractor bears the sole responsibility** for the quality of the work performed.
- C. Quality control services include inspections and tests and related actions including reports, performed by independent agencies, governing authorities, and the Contractor. They do not include Contract observation activities performed by the Architect.
- D. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with Contract Document requirements.

#### 1.3 RESPONSIBILITIES

- A. Contractor Responsibilities: The Contractor shall provide inspections, tests and similar quality control services, specified in individual Specification Sections and as required by governing authorities, and as he may deem necessary to ensure the quality of the work, except where they are specifically indicated to be the Owner's responsibility or are to be provided by another identified entity. Those services specified to be performed by an independent agency and not by the Contractor shall be included in the Contract Sum unless specifically noted otherwise.
  - 1. The **Contractor will engage and pay for** the services of an independent agency to perform specified quality control services to indicate conformance to the Contract Documents. Generally, they include:
    - a. Field testing and lab samples of concrete.
    - b. Compaction tests.
    - c. Structural connection testing.
    - d. Weld testing.

- e. All tests required by the International Building Code, IBC 2006.
  - f. Tests required by testing schedules on Structural Drawings and Specifications.
- 2. Retesting: The Contractor is responsible for retesting where results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance with Contract Document requirements, regardless of whether the original test was the Contractor's responsibility.
  - a. Cost of retesting construction revised or replaced by the Contractor is the Contractor's responsibility, where required tests were performed on original construction.
  - b. Retesting shall be conducted by the Owner’s designated agency, and costs thereof deducted from the Contract amount.
- 3. The Owner may perform independent testing at their discretion. Discovery of faulty work shall cause the Contractor to be responsible for the costs of these tests and for retesting where results indicate non-compliance with the Contract Document requirements, regardless of whether the original test was the Contractor’s responsibility.
- 3. Associated Services: The Contractor shall cooperate with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include but are not limited to:
  - a. Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests.
  - b. Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.
  - c. Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.
  - d. Providing the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.
  - e. Security and protection of samples and test equipment at the Project site.
- B. Duties of the Testing Agency: The independent testing agency engaged to perform inspections, sampling and testing of materials and construction specified in individual Specification Sections shall cooperate with the Architect and Contractor in performance of its duties and shall provide qualified personnel to perform required inspections and tests.
  - 1. The agency shall notify the Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  - 2. The agency is not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.
  - 3. The agency shall not perform any duties of the Contractor.
- C. Coordination: The Contractor and each agency engaged to perform inspections, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition, the Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.

1. The Contractor is responsible for scheduling times for inspections, tests, taking samples and similar activities.

#### 1.4 SUBMITTALS

- A. The independent testing agency shall submit a certified written report of each inspection, test or similar service, to the Architect, in duplicate, unless the Contractor is responsible for the service. If the Contractor is responsible for the service, submit a certified written report of each inspection, test or similar service through the Contractor, in duplicate.
  1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.
  2. Report Data: Written reports of each inspection, test or similar service shall include, but not be limited to:
    - a. Date of issue.
    - b. Project title and number.
    - c. Name, address and telephone number of testing agency.
    - d. Dates and locations of samples and tests or inspections.
    - e. Names of individuals making the inspection or test.
    - f. Designation of the Work and test method.
    - g. Identification of product and Specification Section.
    - h. Complete inspection or test data.
    - i. Test results and an interpretations of test results.
    - j. Ambient conditions at the time of sample-taking and testing.
    - k. Comments or professional opinion as to whether inspected or tested Work complies with Contract Document requirements.
    - l. Name and signature of laboratory inspector.
    - m. Recommendations on retesting.

#### 1.5 QUALITY ASSURANCE

- A. Qualification for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, which are prequalified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories, and which specialize in the types of inspections and tests to be performed.
  1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the State in which the Project is located.

#### PART 2 - PRODUCTS (Not Applicable).

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

- A. General: Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes. Comply with Contract Document requirements for "Cutting and Patching."
- B. Protect construction exposed by or for quality control service activities, and protect repaired construction.
- C. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

**END OF SECTION 014000**

## **SECTION 015000 - TEMPORARY FACILITIES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section specifies requirements for temporary services and facilities, including utilities, construction and support facilities, security and protection.
- B. Temporary utilities required include, but are not limited to:
  - 1. Temporary electric power, as may be required.
  - 2. Telephone service to field office by Contractor.
  - 3. Storm sewer and/or erosion control and detention.
  - 4. Temporary heating of components under construction and of completed spaces to protect from effects of cold and weather, and as may be required by other Sections of the Specifications.
  - 5. Temporary water as may be required for construction activities until permanent water service is established.
- C. Temporary construction and support facilities required include but are not limited to:
  - 1. Field offices and storage sheds.
  - 2. Sanitary facilities, including drinking water.
  - 3. Temporary Project identification signs and bulletin boards.
  - 4. Waste disposal services.
  - 5. Construction aids and miscellaneous services and facilities.
  - 6. Ramps, shoring, cribbing, coverings, etc.
  - 7. Safety fencing around entire project.
  - 8. Project sign
- D. Security and protection facilities required include but are not limited to:
  - 1. Barricades, warning signs, lights, locked enclosures, etc.
  - 2. Environmental protection.

#### **1.3 QUALITY ASSURANCE**

- A. Regulations: Comply with industry standards and applicable laws and regulations if authorities

having jurisdiction, including but not limited to:

1. Building Code requirements.
2. Health and safety regulations.
3. Utility company regulations.
4. Police, Fire Department and Rescue Squad rules.
5. Environmental protection regulations.

#### 1.4 PROJECT CONDITIONS

- A. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. General: Provide new materials; if acceptable to the Architect, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.
- B. Open-Mesh Fencing: Provide a temporary fence construction of plastic woven fencing equivalent to Tenser Safety Barrier no less than 4 feet in height and supported by metal tee posts spaced no more than ten feet apart. Install fencing around entire boundary of work and portions of work as may be necessary.
- C. Project Sign: General Contractor ***may at their discretion*** provide and erect one (1) framework and posts for attachment of signage by General Contractor, Architect, and Owner’s financial institution. The sign shall be maximum 4’ x 8’ and graphics shall be provided by each separate entity for erection by Contractor. No sign of advertisement will be allowed to be displayed other than that specified without written approval of the Architect.

#### 2.2 EQUIPMENT

- A. Temporary Offices: Contractor may, but is not required to, provide a prefabricated or mobile units or similar job-built construction with lockable entrances, operable window and serviceable finishes. Provide heated and air-conditioned units on foundations adequate for normal loading. At such time a designated location within the building is available for an office, which provides the same accommodations as above, and with Owner approval, the temporary office may be discontinued.
- B. Temporary Toilet Units: Provide self-contained single-occupant toilet units of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material. At such time new building toilets are operational

use of self-contained units may be discontinued, however Contractor shall be responsible for any damages as a result of use by Contractor or Sub-Contractors employees or others that are on site as a result of the work under this contract. Do not use plumbing lines for disposal or flushing of construction residues or debris.

- C. First Aid Supplies: Comply with governing regulations.
- D. Fire Extinguishers: Provide hand-carried, portable UL-rated, class "A" fire extinguishers for temporary offices and similar spaces. In other locations provide hand-carried, portable, UL-rated, class "ABC" dry chemical extinguishers, or a combination of extinguishers of NFPA recommended classes for the exposures.
  - 1. Comply with NFPA 10 and 241 for classification, extinguishing agent and size required by location and class of fire exposure.
- E. Telephone, answering machine, and fax machine. Also provide either a ringer, or a pager, or portable cellular phone for job superintendent. Contractor will provide telephone service for job site temporary offices, cable, hardware and labor to install. All usage costs will be paid for by the Contractor.
- F. Email capability.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

### 3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where the company provides only part of the service provide the remainder with matching, compatible materials and equipment; comply with the company's recommendations.
  - 1. Use Charges: Cost or use charges for temporary facilities are not chargeable to the Owner or Architect and will not be accepted as a basis of claims for a Change Order.
- B. Temporary Electric Systems: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include all materials required by utility company or owner for service hookup. If available, the Contractor may utilize power from the existing building or service.
  - 1. At such time as the permanent distribution system, (transformer, meter, and main distribution panels and switches) is operational and accepted by the utility and Architect, the Owner will

- thereafter pay for electric power.
- 2. Provide temporary power distribution, panels, outlets, etc.
- 3. Provide temporary lighting as required to perform work in safe manner and to quality required.
- 4. Provide security lighting for building and site to inhibit vandalism and intrusions.
- C. Temporary Communications: Provide temporary telephone service for all personnel engaged in construction activities, throughout the construction period. Install telephone on a separate line for each temporary office and first aid station. All installation & usage costs for temporary phone service will be by the Contractor.
  - 1. At each telephone, post a list of important telephone numbers.
  - 2. Provide an answering machine at the primary phone location in the temporary office.
  - 3. Provide a fax machine in the temporary office.
  - 4. Project foreman/superintendent is encouraged to carry a cellular phone but is not a requirement and is not a substitute for an answering machine.
- D. Temporary Water Service: Contractor to provide temporary water service as required for construction services until permanent water service is established. Water service at existing adjacent building may be used by the Contractor as long as the Owner’s service is available.
- E. Gas Service: Contractor to provide temporary gas service if needed for construction services.
- F. Prudent Use of Services: Owner will pay monthly usage costs, once permanent electric and water service is established. Contractor will use services only as necessary to perform the work and will endeavor to avoid wasted usage and imprudent usage of energy services. Excessive or irresponsible usage and/or damages to utilities which cause excessive usage charges or repairs shall be borne by the Contractor. Contractor shall turn off lights at night (except as needed for security), shall keep openings in building closed and protected, and in all ways use utility services as if Contractor were paying for the services. Failure to do so may require Owner to back charge misuse or excessive usage costs to Contractor.
- G. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains. Such embankments shall meet all requirements of governing agencies.

### 3.3 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION

- A. Locate field offices, storage sheds, sanitary facilities and other temporary construction and support facilities for easy access.
  - 1. Maintain temporary construction and support facilities until near Substantial Completion. Remove prior to Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
- B. Field Offices: Provide insulated, weathertight temporary offices of sufficient size to accommodate required office personnel at the Project site. Keep the office clean and orderly for use for small progress meetings. Provide desk space.
- C. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Use of pit-type privies will not be permitted.



- D. Drinking Water Facilities: Provide containerized tap-dispenser bottled-water type drinking water units, including paper supply, or other approved sanitary drinking water service.
  
- E. Termination and Removal: Unless the Architect requests that it be maintained longer, remove each temporary facility when the need has ended, or when replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged Work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired.
  - 1. Materials and facilities that constitute temporary facilities are property of the Contractor. The Owner reserves the right to take possession of Project identification signs.

**END OF SECTION 015000**

## **SECTION 016000 - MATERIALS AND EQUIPMENT**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section specifies administrative and procedural requirements governing the Contractor's selection of products for use in the Project.
- B. Administrative procedures for handling requests for substitutions made after award of the Contract are included under Section "Product Substitutions."

#### **1.3 DEFINITIONS**

- A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms are self-explanatory and have well recognized meanings in the construction industry.
  - 1. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
    - a. "Named Products" are items identified by manufacturer's product name, including make or model designation, indicated in the manufacturer's published product literature, that is current as of the date of the Contract Documents.
  - 2. "Materials" are products that are substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.
  - 3. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections such as wiring or piping.

#### **1.4 QUALITY ASSURANCE**

- A. Source Limitations: To the fullest extent possible, provide products of the same kind, from a single source.

#### **1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store and handle products in accordance with the manufacturer's recommendations, using means and methods that will prevent damage, deterioration and loss, including theft.
  - 1. Deliver products to the site in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.
  - 2. Inspect products upon delivery to ensure compliance with the Contract Documents, and to ensure that products are undamaged and properly protected.
  - 3. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.
  - 4. Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

## PART 2 - PRODUCTS

### 2.1 PRODUCT SELECTION

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, unused at the time of installation.
  - 1. Provide products complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.
- B. Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulations, not by previous Project experience. Procedures governing product selection include the following:
  - 1. Proprietary Specification Requirements: Where only a single product or manufacturer is named, provide the product indicated. No substitutions will be permitted.
  - 2. Semi-proprietary Specification Requirements: Where two or more products or manufacturers are named, provide one of the products indicated. No substitutions will be permitted.
    - a. Where products or manufacturers are specified by name, accompanied by the term "or equal," or "or approved equal" comply with the Contract Document provisions concerning "substitutions" to **obtain approval** for use of an unnamed product.
  - 3. Non-Proprietary Specifications: When the Specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with Contract requirements. Comply with Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.
  - 4. Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.
  - 5. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are

recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product is specified for a specific application.

- a. Manufacturer's recommendations may be contained in published product literature, or by the manufacturer's certification of performance.
6. Compliance with Standards, Codes and Regulations: Where the Specifications only require compliance with an imposed code, standard or regulation, select a product that complies with the standards, codes or regulations specified.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF PRODUCTS

- A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other Work.
  1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

**END OF SECTION 016000**

## **SECTION 017000 - PROJECT CLOSEOUT**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:
  - 1. Inspection procedures.
  - 2. Project record document submittal.
  - 3. Operating and maintenance manual submittal.
  - 4. Submittal of warranties.
  - 5. Final cleaning.
- B. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions 2 through 16.

#### **1.3 SUBSTANTIAL COMPLETION**

- A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.
  - 1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
    - a. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
  - 2. Advise Owner of pending insurance change-over requirements.
  - 3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
  - 4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.
  - 5. Deliver tools, spare parts, extra stock, and similar items.

6. Complete start-up testing of systems, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.
  7. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.
- B. **Inspection Procedures:** On receipt of a request for inspection, the Architect will either proceed with inspection or advise the Contractor of unfilled requirements. The Architect will prepare the Certificate of Substantial Completion following inspection or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.
1. Upon written statement from the Contractor that the Work is complete, the Architect will repeat the inspection and notification procedure. **In the event the work is not complete, the Architect will repeat the inspection process one (1) additional time only. Further inspection procedures will be at the expense of the Contractor.**
  2. Results of the completed inspection will form the basis of requirements for final acceptance.
  3. Release of retainage or portions thereof will not be approved without Consent of Surety.
  4. Release of retainage or portions thereof will be determined by a multiplier of three (3) applied to all remaining work not complete. Inspections to determine status of work complete and, therefore, release of retainage and pay applications are contingent upon the limits to number of inspections indicated above in 1.3.B.1.
  5. Also see Supplemental Conditions.

#### 1.4 FINAL ACCEPTANCE

- A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request. (See Supplemental Overall Conditions also.)
1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
  2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
  3. Submit a certified copy of the Architect's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Architect.
  4. Submit consent of surety to final payment.
  5. Submit a final liquidated damages settlement statement.
  6. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  7. Submit record drawings, maintenance manuals, final project photographs, damage or settlement survey, property survey, and similar final record information.

**B. INSPECTION SUMMARY**

- 1. Architect will conduct one (1) inspection at notification for Substantial Completion. Request for inspection shall only be requested after construction is complete and final cleaning is done.**
- 2. Architect will conduct one (1) inspection for Final Completion.**
- 3. Any additional inspections for Substantial Completion or Final Completion will be at the cost of the Contractor.**

**1.5 RECORD DOCUMENT SUBMITTALS**

- A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Architect's reference during normal working hours.
- B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
  1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
  2. Mark new information that is important to the Owner but was not shown on Contract Drawings or Shop Drawings.
  3. Note related Change Order numbers where applicable.
  4. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.
- C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and Product Data.
  1. Upon completion of the Work, submit record Specifications to the Architect for the Owner's records.
- D. Record Product Data: Maintain one copy of each Product Data submittal. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations. Give particular attention to concealed products and portions of the Work which cannot otherwise be readily discerned later by direct observation. Note related Change Orders and mark-up of record drawings and Specifications.

1. Upon completion of mark-up, submit complete set of record Product Data to the Architect for the Owner's records.
- E. Record Sample Submitted: Immediately prior to the date or dates of Substantial Completion, the Contractor will meet at the site with the Architect and the Owner's personnel to determine which of the submitted Samples that have been maintained during progress of the Work are to be transmitted to the Owner for record purposes. Comply with delivery to the Owner's Sample storage area.
- F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Architect for the Owner's records.
- G. Maintenance Manuals: Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 2-inch, 3-ring vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information:
  1. Emergency instructions.
  2. Spare parts list.
  3. Copies of warranties.
  4. Wiring diagrams.
  5. Recommended "turn around" cycles.
  6. Inspection procedures.
  7. Shop Drawings and Product Data.
  8. Fixture lamping schedule.

## PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION

### 3.1 CLOSEOUT PROCEDURES

- A. Operating and Maintenance Instructions: Arrange for each installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of the following items:
  1. Maintenance manuals.
  2. Record documents.
  3. Spare parts and materials.
  4. Tools.
  5. Lubricants.
  6. Fuels.



7. Identification systems.
8. Control sequences.
9. Hazards.
10. Cleaning.
11. Warranties and bonds.
12. Maintenance agreements and similar continuing commitments.

B. As part of instruction for operating equipment, demonstrate the following procedures:

1. Start-up.
2. Shutdown.
3. Emergency operations.
4. Noise and vibration adjustments.
5. Safety procedures.
6. Economy and efficiency adjustments.
7. Effective energy utilization.

### 3.2 FINAL CLEANING

- A. General: General cleaning during construction is required by the General Conditions and included in Section "Temporary Facilities".
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
  1. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.
    - a. Remove labels that are not permanent labels.
    - b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
    - c. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.
    - d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
    - e. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.
- C. Removal of Protection: Remove temporary protection and facilities installed for protection of the

Work during construction.

- D. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.
  - 1. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

**END OF SECTION 017000**

## **SECTION 017300 - EXECUTION**

### **PART 1 - GENERAL**

#### **1.1 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. Installation of the Work.
3. Cutting and patching.
4. Coordination of Owner-installed products.
5. Starting and adjusting.
6. Protection of installed construction.
7. Correction of the Work.

B. Related Sections:

1. Division 01 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

#### **1.2 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 the Architect before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.

a. 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.

b. 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.

2. 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.

### 1.3 WARRANTY

A. 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.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

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 the Architect for the visual and functional performance of in-place materials.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping, underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, 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. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

2. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
3. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
4. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility & Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of the Contractor, submit a request for information to Architect according to requirements in Division 01 Section "Project Management and Coordination."

### 3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect and Construction Manager promptly.
- B. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- C. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

### 3.4 FIELD ENGINEERING

- A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

### 3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. 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.

G. 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.

H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

### 3.6 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Temporary Support: Provide temporary support of work to be cut.

C. 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.

D. Adjacent Occupied Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

E. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

F. 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 Division 31 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.
- G. 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.
  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.
  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.
- H. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

### 3.7 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: Comply with qualification requirements in Division 01 Section "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 manufacturer's written instructions for temperature and relative humidity.



### 3.9 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.

1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

B. Restore permanent facilities used during construction to their specified condition.

C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.

D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.

E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

**END OF SECTION 017300**

## **SECTION 017400 - WARRANTIES AND BONDS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturer’s standard warranties on products and special warranties.
  - 1. Refer to the General Conditions for terms of the Contractor's special warranty of workmanship and materials.
  - 2. General closeout requirements are included in Section "Project Closeout."
  - 3. Specific requirements for warranties for the Work and products and installations that are specified to be warranted, are included in the individual Sections of Divisions-2 through -16.
- B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

#### **1.3 WARRANTY REQUIREMENTS**

- A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
- B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

- D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.
  - 1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
- E. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

#### 1.4 SUBMITTALS

- A. Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.
  - 1. Refer to individual Sections of Divisions 2 through 16 for specific content requirements, and particular requirements for submittal of special warranties.
  - 2. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 - PRODUCTS (not applicable).

#### PART 3 - EXECUTION

##### 3.1 SCHEDULE OF WARRANTIES

- A. General Contractors Warranty: The General Contractor shall provide the Owner with a minimum one-year warranty on the entire project in addition to specific warranties. Warranty period shall begin at time of Substantial Completion; except that for punch list items, and/or items not deemed complete or properly functioning as intended, the warranty shall begin from the point the Owner/Architect accepts the item as complete.
- B. Schedule: Provide warranties and bonds on products and installations not specifically mentioned in this section but included in Sections 2-16.

**END OF SECTION 017400**

## **SECTION 017500 – PROGRESS CLEANING**

### **GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section includes administrative and procedural requirements for cleaning during the Project.
- B. Environmental Requirements: Conduct cleaning and waste-disposal operations in compliance with local laws and ordinances. Comply fully with federal and local environmental and anti-pollution regulations.
  - 1. Do not dispose of volatile wastes, such as mineral spirits, oil, or paint thinner, in storm or sanitary drains.
  - 2. Burning or burying of debris, rubbish, or other waste material on the premises is not permitted.

### **PRODUCTS**

#### **2.2 MATERIALS**

- A. Cleaning Agents: Use cleaning materials and agents recommended by the manufacturer or fabricator for the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

### **EXECUTION**

#### **3.2 PROGRESS CLEANING**

- A. General
  - 1. Retain all stored items in an orderly arrangement allowing maximum access, not impeding drainage or traffic, and providing the required protection of materials.
  - 2. Do not allow the accumulation of scrap, debris, waste material, and other items not required for construction of this Work.
  - 3. At least twice each month, and more often, if necessary, completely remove all scrap, debris, and waste material from the job site.

4. Provide adequate storage for all items awaiting removal from the job site, observing all requirements for fire protection and protection of the ecology.

A. Site:

1. Daily, inspect the site and pick up all scrap, debris, and waste material. Remove all such items to the place designated for their storage.
2. Weekly, inspect all arrangements of materials stored on the site. Re-stack, tidy, or otherwise service all material arrangements.
3. Maintain the site in a neat and orderly condition at all times.

A. Structures:

1. Daily, inspect the structures and pick up all scrap, debris, and waste material. Remove all such items to the place designated for their storage.
2. Weekly, sweep all interior spaces clean. “Clean,” for the purposes of this paragraph, shall be interpreted as meaning free from dust and other material capable of being removed by use of reasonable effort and handheld broom.
3. In preparation for installation of succeeding materials, clean the structures or pertinent portions thereof to the degree of cleanliness recommended by the manufacturer of the succeeding material, using all equipment and materials required to achieve the required cleanliness.
4. Following the installation of finish floor materials, clean the finish floor daily while work is being performed in the space in which finish materials have been installed. “Clean,” for the purposes of this subparagraph, shall be interpreted as meaning free from all foreign material which, in the opinion of the Construction Representative, may be injurious to the finish of the finish floor material.

## 6.2 FINAL CLEANING

- A. General: Provide final cleaning operations when indicated. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of Work to the condition expected from a commercial building cleaning and maintenance program. Comply with manufacturer’s instructions.
- A. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for the entire Project or a portion of the Project.
1. Clean the Project Site, yard and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and foreign substances.
  2. Sweep paved areas broom clean. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
  3. Remove petrochemical spills, stains, and other foreign deposits.
  4. Remove tools, construction equipment, machinery, and surplus material from the site.
  5. Remove snow and ice to provide safe access to the building.

6. 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.
  7. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
  8. Broom clean concrete floors in unoccupied spaces.
  9. Vacuum clean carpet and similar soft surfaces removing debris and excess nap. Shampoo, if required.
  10. Clean transparent material, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
  11. Remove labels that are not permanent labels.
  12. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
    - a. Do not paint over “UL” and similar labels, including mechanical and electrical nameplates.
  13. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
  14. Clean plumbing fixtures to a sanitary condition free of stains, including stains resulting from water exposure.
  15. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
  16. Clean ducts, blowers, and coils if units were operated without filters during construction.
  17. Clean, food-service equipment to a sanitary condition, ready and acceptable for its intended use.
  18. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs and defective and noisy starters in fluorescent and mercury vapor fixtures.
  19. Leave the Project clean and ready for occupancy.
- B. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid the Project of rodents, insects, and other pests. Comply with regulations of local authorities.
- C. Removal of Protection: Remove temporary protection and facilities installed during construction to protect previously completed installations during the remainder of the construction period.
- D. Compliances: Comply with governing regulations and safety standards for cleaning operations. Remove waste materials from the site and dispose of lawfully.
1. Where extra materials of value remain after Final Acceptance by the Owner, they become the Owner’s property.

**END OF SECTION 017300**

## **SECTION 024119 - SELECTIVE STRUCTURE DEMOLITION**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Demolition and removal of selected portions of building or structure.
  - 2. Demolition and removal of selected site elements.
  - 3. Salvage of existing items to be reused or recycled.
- B. Related Requirements:
  - 1. Division 01 Section "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
  - 2. Division 01 Section "Execution" for cutting and patching procedures.
  - 3. Division 31 Section "Site Clearing" for site clearing and removal of above- and below-grade improvements.

#### **1.3 DEFINITIONS**

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

#### **1.4 MATERIALS OWNERSHIP**

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



- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

- 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

#### 1.5 PREINSTALLATION MEETINGS

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

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

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Pre-demolition Photographs or Video: Submit before Work begins.

#### 1.7 FIELD CONDITIONS

- A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

- 1. Before selective demolition, Owner will remove any items from the project area that they wish to keep. The Owner’s representative will tag any items for salvage by a method agreeable to both parties. Any remaining items required for removal for new construction shall be removed by the demolition contractor.

- B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

- C. 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.

- D. Hazardous Materials: If present or encountered, hazardous materials shall to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

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

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.
- B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.
- C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- E. 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.
  - 1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.
  - 2. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.
- F. Survey of Existing Conditions: Record existing conditions by use of measured drawings, preconstruction photographs, and/or videotapes.

1. Inventory and record the condition of items to be removed and salvaged. Provide photographs and/or video of conditions that might be misconstrued as damage caused by salvage operations.
2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

### 3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
  1. Comply with requirements for existing services/systems interruptions specified in Division 01 Section "Summary."
- B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
  1. Owner / Owners Facility Manager will arrange to shut off indicated services/systems when requested by Contractor.
  2. Arrange to shut off indicated 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 to be removed.
    - a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    - b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
    - c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
    - d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
    - e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
    - f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material, unless noted otherwise.
    - g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material, unless noted otherwise.

### 3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  - 1. Comply with requirements for access and protection specified in Division 01 Section "Temporary Facilities and Controls."
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
  - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
  - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
  - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
  - 4. Cover and protect furniture, furnishings, and equipment that have not been removed. If plastic sheeting is used for protection, provide min. 6 mil sheeting. Coordinate with Owner for sequencing of work and what furniture/equipment will need to be moved per area.
  - 5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 01 Section "Temporary Facilities and Controls."
- C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
  - 1. Strengthen or add new supports when required during progress of selective demolition.

### 3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
  - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
  - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.

3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
  5. Maintain adequate ventilation when using cutting torches.
  6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
  7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
  8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  9. Dispose of demolished items and materials promptly.
- B. Do not demolish building elements beyond what is indicated on Drawings without Architect's approval.
- C. 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 reinstalled in their original locations after selective demolition operations are complete.

### 3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

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

3.6 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
  - 1. Do not allow demolished materials to accumulate on-site.
  - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
  - 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
  - 4. Comply with requirements specified in Division 01 Section "Construction Waste Management and Disposal."
- B. Burning: Burning of demolished materials will not be permitted, if at all.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

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

**END OF SECTION 024119**

## **SECTION 033000 - CAST-IN-PLACE CONCRETE**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes.
- B. Related Requirements:

#### **1.3 DEFINITIONS**

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.
- B. W/C Ratio: The ratio by weight of water to cementitious materials.

#### **1.4 PREINSTALLATION MEETINGS**

- A. Preinstallation Conference: Conduct conference at Project site.
  - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
    - a. Contractor's superintendent.
    - b. Independent testing agency responsible for concrete design mixtures.
    - c. Ready-mix concrete manufacturer.
    - d. Concrete Subcontractor.
    - e. Special concrete finish Subcontractor.
  - 2. Review special inspection and testing and inspecting agency procedures for field quality control, construction contraction and isolation joints, and joint-filler strips, vapor-retarder installation, steel reinforcement installation, and concrete protection.

#### **1.5 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
  - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.

- C. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
  - 1. Location of construction joints is subject to approval of the Architect.
- D. Samples: For water stops vapor retarder.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, manufacturer, and testing agency.
- B. Material Certificates: For each of the following, signed by manufacturers:
  - 1. Cementitious materials.
  - 2. Admixtures.
  - 3. Form materials and form-release agents.
  - 4. Steel reinforcement and accessories.
  - 5. Water stops.
  - 6. Curing compounds.
  - 7. Floor and slab treatments.
  - 8. Bonding agents.
  - 9. Adhesives.
  - 10. Vapor retarders.
  - 11. Semirigid joint filler.
  - 12. Joint-filler strips.
- C. Material Test Reports: For the following, from a qualified testing agency:
  - 1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- D. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

#### 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
  - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
  - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
  - 2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.



- D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.4/D 1.4M.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

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

#### 1.9 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
  - 1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
  - 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
  - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 and as follows:
  - 1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  - 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

### PART 2 - PRODUCTS

#### 2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
  - 1. ACI 301.
  - 2. ACI 117.

#### 2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
  - 1. Plywood, metal, or other approved panel materials.
  - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:

- a. High-density overlay, Class 1 or better.
  - b. Medium-density overlay, Class 1 or better; mill-release agent treated, and edge sealed.
  - c. Structural 1, B-B or better; mill oiled, and edge sealed.
  - d. B-B (Concrete Form), Class 1 or better; mill oiled, and edge sealed.
3. Overlaid Finish birch plywood.
- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.
- E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- H. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
  1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- I. Form Ties: Factory-fabricated, removable or snap-off glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
  1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
  2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
  3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

## 2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Plain-Steel Welded-Wire Reinforcement: ASTM A 1064/A 1064M, plain, fabricated from as-drawn steel wire into flat sheets.

## 2.4 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60, plain-steel bars, cut true to length with ends square and free of burrs.
- B. Zinc Repair Material: ASTM A 780/A 780M.

- C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
  - 1. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

## 2.5 CONCRETE MATERIALS

- A. 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.
- B. Cementitious Materials:
  - 1. Portland Cement: ASTM C 150/C 150M, [Type I gray.
  - 2. Fly Ash: ASTM C 618, Class F or C.
  - 3. Slag Cement: ASTM C 989/C 989M, Grade 100 or 120.
  - 4. Blended Hydraulic Cement: ASTM C 595/C 595M, Type IS, portland blast-furnace slag Type IP, portland-pozzolan Type IT, ternary blended cement.
  - 5. Silica Fume: ASTM C 1240, amorphous silica.
- C. Normal-Weight Aggregates: ASTM C 33/C 33M, **Class 3S, Class 3M or Class 1N**. coarse aggregate or better, graded. Provide aggregates from a single source.
  - 1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
  - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Air-Entraining Admixture: ASTM C 260/C 260M.
- E. 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.
- F. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.
  - 1. Products: Subject to compliance with requirements available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Euclid Chemical Company (The), an RPM company; ARRMATECT EUCON BCN EUCON CIA.
    - b. Grace Construction Products, W. R. Grace & Co.; DCI.
    - c. Sika Corporation; CNI.

- G. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Cortec Corporation; MCI-2000 MCI-2005NS.
    - b. Grace Construction Products, W. R. Grace & Co.; DCI-S.
    - c. Sika Corporation; FerroGard 901.
- H. Water: ASTM C 94/C 94M.

## 2.6 WATERSTOPS

- A. Flexible Rubber Waterstops: CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricated corners, intersections, and directional changes.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Greenstreak.
    - b. Williams Products, Inc.
  - 2. Profile: Flat dumbbell without center bulb.
  - 3. Dimensions: 4 inches by 3/16 inch thick, nontapered.

## 2.7 VAPOR RETARDERS

- A. Sheet Vapor Retarder: Polyethylene sheet, ASTM D 4397, not less than 10 mils thick.

## 2.8 CURING MATERIALS

- A. It shall be the Contractor’s Option to wet cure or to use curing compounds at all slab on grade locations. Note, if curing compounds are used, then they will need to be fully removed where slab is scheduled to receive flooring material.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry. Contractor to thoroughly clean the concrete slab as the cover is removed.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet. Contractor to thoroughly clean the concrete slab as the cover is removed.
- D. Water: Potable.
- E. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. BASF Construction Chemicals - Building Systems; Confilm.
    - b. Bon Tool Co.; 32-301-B7 BonWay Evaporation Retarder.

- c. Brickform, a division of Solomon Colors, Inc.; Evaporation Retarder.
  - d. ChemMasters; SprayFilm.
  - e. Dayton Superior; AquaFilm J74.
  - f. Euclid Chemical Company (The), an RPM company; EUCOBAR.
  - g. Kaufman Products, Inc.; VaporAid.
  - h. L&M Construction Chemicals, Inc.; E-CON.
  - i. Lambert Corporation; Lambco Skin.
  - j. Meadows, W. R., Inc.; EVAPRE.
  - k. Metalcrete Industries; Waterhold.
  - l. Nox-Crete Products Group; Monofilm.
  - m. Sika Corporation.; SikaFilm.
  - n. SpecChem, LLC; SpecFilm.
  - o. TK Products; TK-2120 TRI-FILM.
  - p. Vexcon Chemicals Inc.; Certi-Vex EnvioAssist.
- F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
- 1. Products: Subject to compliance with requirements available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Anti-Hydro International, Inc.; A-H Curing Compound #2 DR WB.
    - b. ChemMasters Inc.; Safe-Cure Clear DR.
    - c. Dayton Superior; Clear Resin Cure J11W.
    - d. Euclid Chemical Company (The), an RPM company; Kurez DR VOX.
    - e. Kaufman Products, Inc.; DR Cure.
    - f. L&M Construction Chemicals, Inc.; L&M Cure R.
    - g. Lambert Corporation; Aqua Kure - Clear.
    - h. Meadows, W. R., Inc.; 1100-CLEAR.
    - i. Nox-Crete Products Group; Res-Cure DH DS.
    - j. Right Pointe; Clear Water Resin.
    - k. SpecChem, LLC; PaveCure Rez.
    - l. TK Products; TK-2519 DC WB.
    - m. Vexcon Chemicals Inc.; Certi-Vex Envio Cure 100.
- G. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. BASF Construction Chemicals, LLC; Kure-N-Seal 25 LV.
    - b. ChemMasters; Spray-Cure & Seal 25.
    - c. Dayton Superior Corporation; Cure & Seal 1315 J22UV.
    - d. Euclid Chemical Company (The), an RPM company; Super Diamond Clear.
    - e. Kaufman Products, Inc.; Krystal 25.
    - f. L&M Construction Chemicals, Inc.; Lumiseal Plus.
    - g. Lambert Corporation; UV Super Seal.
    - h. Meadows, W. R., Inc.; CS-309-30.
    - i. Metalcrete Industries; Seal N Kure 30.
    - j. Nox-Crete Products Group; Cure & Seal 1315 A.
    - k. Right Pointe; Right Sheen 30.
    - l. SpecChem, LLC; Cure & Seal 25.

- m. TK Products; Kure & Seal 1315.
    - n. Vexcon Chemicals, Inc.; Certi-Vex AC1315.
  - 2. Curing and sealing compounds 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."
- H. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. BASF Construction Chemicals - Building Systems; Kure 1315.
    - b. ChemMasters Inc.; Polyseal WB.
    - c. Dayton Superior Corporation; Cure & Seal 1315 J22WB.
    - d. Euclid Chemical Company (The), an RPM company; Super Diamond Clear VOX.
    - e. Kaufman Products, Inc.; Krystal 25 Emulsion.
    - f. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
    - g. Lambert Corporation; UV Safe Seal.
    - h. Meadows, W. R., Inc.; VOCOMP-30.
    - i. Metalcrete Industries; Metcure 30.
    - j. Right Pointe; Right Sheen WB 30.
    - k. SpecChem, LLC; Cure & Seal WB 25.
    - l. TK Products; Bright Kure & Seal 1315 VOC.
    - m. Vexcon Chemicals, Inc.; StarSeal 1315.
  - 2. Curing and sealing compounds shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

## 2.9 RELATED MATERIALS

- A. Bonding Agent: ASTM C 1059/C 1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- B. Reglets: Fabricate reglets of not less than 0.022-inch- thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- C. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

## 2.10 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
- B. Cementitious Materials Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
  - 1. Fly Ash: 20 percent as long as ambient air temperature is above 50 degrees Fahrenheit.

- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
  - 1. Use high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
  - 2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
  - 3. Use water-reducing admixture in pumped concrete and, and concrete with a w/c ratio below 0.50.
  - 4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

#### 2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings: Normal-weight concrete.
  - 1. Minimum Compressive Strength 3000 psi at 28 days.
  - 2. Maximum W/C Ratio: 0.52
  - 3. Slump Limit: 4 inches8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture <, plus or minus 1 inch.
- B. Foundation Walls, Interior Slabs on Grade, & Pedestals: Normal-weight concrete.
  - 1. Minimum Compressive Strength: 3500 psi at 28 days.
  - 2. Maximum W/C Ratio: 0.50.
  - 3. Slump Limit:[4 inches8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
  - 4. Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
- C. Exterior Slabs-on-Grade: Normal-weight concrete.
  - 1. Minimum Compressive Strength: Interior 4000 psi at 28 days.
  - 2. Maximum W/C Ratio: 0.45.
  - 3. Minimum Cementitious Materials Content: [5 ¾ bags/cu. yd.
  - 4. Slump Limit:4 inches, plus or minus 1 inch.
  - 5. Air Content: 6 percent, plus or minus 1.0 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

#### 2.12 FABRICATING REINFORCEMENT

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

#### 2.13 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
  - 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
  - 1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
  - 2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
  - 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

### PART 3 - EXECUTION

#### 3.1 FORMWORK INSTALLATION

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
  - 1. Class A, 1/8 inch for smooth-formed finished surfaces.
  - 2. Class B, 1/4 inch or rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
  - 1. Install keyways, reglets, recesses, and the like, for easy removal.
  - 2. Do not use rust-stained steel form-facing material.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.



- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

### 3.2 EMBEDDED 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.
  - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
  - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
  - 3. Install dovetail anchor slots in concrete structures as indicated.

### 3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for **24** hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

### 3.4 VAPOR-RETARDER INSTALLATION

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
  - 1. Lap joints 6 inches and seal with manufacturer's recommended tape.
- B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder according to manufacturer's written instructions.

### 3.5 STEEL REINFORCEMENT INSTALLATION

- A. General: 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.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
  1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

### 3.6 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
  1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
  2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
  3. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
  4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

### 3.7 WATERSTOPS

- A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work.

### 3.8 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- C. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
  1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
  2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
  3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- D. Deposit and consolidate concrete for slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
  1. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  2. Maintain reinforcement in position on chairs during concrete placement.
  3. Screed slab surfaces with a straightedge and strike off to correct elevations.
  4. Slope surfaces uniformly to drains where required.
  5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

### 3.9 FINISHING FORMED SURFACES

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

3.10 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restrengthening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restrengthening until surface is left with a uniform, smooth, granular texture.
  - 1. Apply float finish to surfaces **to receive trowel finish and to the tops of exposed foundation walls.**
- C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
  - 1. Apply a trowel finish to surfaces all interior slabs on grade.
  - 2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
    - a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
  - 3. Finish and measure surface, so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch.
- D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin set method. While concrete is still plastic, slightly scarify surface with a fine broom.
  - 1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
  - 1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.11 MISCELLANEOUS CONCRETE ITEM INSTALLATION

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

3.12 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
  - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
  - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
    - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
    - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
    - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies does not interfere with bonding of floor covering used on Project.
  - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
    - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer.
  - 4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.13 LIQUID FLOOR TREATMENT APPLICATION

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
  - 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
  - 2. Do not apply to concrete that is less than 28 days' old.
  - 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.
- B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.14 JOINT FILLING

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

3.15 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
  - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
  - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar matches surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
  1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
  2. After concrete has cured at least 14 days, correct high areas by grinding.
  3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
  4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
  5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
  6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete, except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
  7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

### 3.16 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare test reports.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:

1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.
7. Verification of concrete strength before removal of shores and forms from beams and slabs.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C 31/C 31M.
  - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
  - b. Cast and field cure **two** sets of two standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
  - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
  - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.



9. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
  10. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
  11. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
  12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
  13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- E. Measure floor and slab flatness and levelness according to ASTM E 1155 within 48 hours of finishing.

**3.17 PROTECTION OF LIQUID FLOOR TREATMENTS**

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

**END OF SECTION 033000**

## **SECTION 061053 - MISCELLANEOUS ROUGH CARPENTRY**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section Includes:

- 1. Framing with dimension lumber.
- 2. Rooftop equipment bases and support curbs.
- 3. Wood blocking and nailers.
- 4. Wood furring and grounds.
- 5. Wood sleepers.
- 6. Utility shelving.
- 7. Plywood backing panels.

- B. Related Requirements:

- 1. Division 06 finish carpentry Sections for nonstructural carpentry items exposed to view and not specified in another Section.

#### **1.3 DEFINITIONS**

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

#### 1.4 ACTION SUBMITTALS

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

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:
  - 1. Preservative-treated wood.
  - 2. Fire-retardant-treated wood.
  - 3. Power-driven fasteners.
  - 4. Powder-actuated fasteners.
  - 5. Expansion anchors.
  - 6. Metal framing anchors.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

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

### PART 2 - PRODUCTS

#### 2.1 WOOD PRODUCTS, GENERAL

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

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

B. Maximum Moisture Content of Lumber: **19 percent** unless otherwise indicated.

## 2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Preservative Treatment by Pressure Process: AWPAC U1; Use Category UC2.

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

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

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

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

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

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood framing members that are less than 18 inches above the ground in crawl spaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

## 2.3 FIRE-RETARDANT-TREATED MATERIALS

A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
  - 1. Use treatment that does not promote corrosion of metal fasteners.
  - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
  - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
  - 4. Design Value Adjustment Factors: Treated lumber shall be tested according ASTM D 5664, and design value adjustment factors shall be calculated according to ASTM D 6841.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.
- D. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
  - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.
- E. For exposed items indicated to receive a stained or natural finish, use chemical formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.
- F. Application: Treat items indicated on Drawings, and the following:
  - 1. Within fire rated assemblies only.

## 2.4 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
  - 1. Blocking.
  - 2. Nailers.
  - 3. Rooftop equipment bases and support curbs.
  - 4. Cants.
  - 5. Furring.
  - 6. Grounds.
  - 7. Utility shelving.

- B. For items of dimension lumber size, provide **No. 2** grade lumber and any of the following species:
  - 1. Hem-fir (north); NLGA.
  - 2. Mixed southern pine; SPIB.
  - 3. Spruce-pine-fir; NLGA.
  - 4. Hem-fir; WCLIB or WWPA.
  - 5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
  - 6. Western woods; WCLIB or WWPA.
  - 7. Northern species; NLGA.
  - 8. Eastern softwoods; NeLMA.
- C. For concealed boards, provide lumber with **19** percent maximum moisture content and **any** of the following species and grades:
  - 1. Mixed southern pine, **No. 2** grade; SPIB.
  - 2. Hem-fir or hem-fir (north), **No. 2 Common** grade; NLGA, WCLIB, or WWPA.
  - 3. Spruce-pine-fir (south) or spruce-pine-fir, **No. 2 Common** grade; NeLMA, NLGA, WCLIB, or WWPA.
  - 4. Eastern softwoods, **No. 2 Common** grade; NELMA.
  - 5. Northern species, **No. 2 Common** grade; NLGA.
  - 6. Western woods, **No. 2 Common** grade; WCLIB or WWPA.
- D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

## 2.5 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: DOC PS 1, Exterior, AC, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.
  - 1. Paint per Finish Schedules

## 2.6 FASTENERS

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

1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening to Metal Framing: ASTM C 1002/ASTM C 954, length as recommended by screw manufacturer for material being fastened.
- F. Lag Bolts: ASME B18.2.1.
- G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.
- H. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.
  1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
  2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.

## 2.7 METAL FRAMING ANCHORS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to the following:
  1. Cleveland Steel Specialty Co.
  2. KC Metals Products, Inc.
  3. Phoenix Metal Products, Inc.
  4. Simpson Strong-Tie Co., Inc.
  5. USP Structural Connectors.
- B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.
  1. Use for interior locations unless otherwise indicated.
- C. Hot-Dip Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.

1. Use for wood-preservative-treated lumber and where indicated.

D. Stainless-Steel Sheet: ASTM A 666, **Type 304**.

1. Use for exterior locations and where indicated.

2.8 MISCELLANEOUS MATERIALS

A. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.

1. Adhesives shall have a VOC content of **70** g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesives shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- B. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- C. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- D. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.
- E. Metal Framing Anchors: Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- F. Do not splice structural members between supports unless otherwise indicated.
- G. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
  1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.



- H. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
  - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
  - 2. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
  - 3. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.
- I. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- J. Comply with AWP A M4 for applying field treatment to cut surfaces of preservative-treated lumber.
  - 1. Use inorganic boron for items that are continuously protected from liquid water.
  - 2. Use copper naphthenate for items not continuously protected from liquid water.
- K. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. NES NER-272 for power-driven fasteners.
  - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
- L. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

### 3.2 WOOD GROUND, SLEEPER, BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

### 3.3 FURRING INSTALLATION

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.
- B. Furring to Receive Plywood or Hardboard Paneling: Install resilient metal furring strips horizontally at 24 inches o.c., unless indicated otherwise. See details on Drawings.
- C. Furring to Receive Gypsum Board: Install resilient metal furring strips horizontally at 16 inches o.c., unless indicated otherwise. See details on Drawings.

### 3.4 PROTECTION

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

**END OF SECTION 061053**

## **SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Plastic-laminate cabinets.
  - 2. Plastic-laminate countertops.
  - 3. Solid-surfacing-material countertops.
  - 4. Closet and utility shelving.

#### **1.3 DEFINITIONS**

- A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction before woodwork installation.

#### **1.4 SUBMITTALS**

- A. Product Data: For each type of product indicated, including, cabinet hardware and accessories, handrail brackets, and finishing materials and processes.
- B. Product Data: For high-pressure decorative laminate, adhesive for bonding plastic laminate, solid-surfacing material, fire-retardant-treated materials, cabinet hardware and accessories, handrail brackets, and finishing materials and processes.
  - 1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
  - 1. Show details full size.
  - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
  - 3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, and other items installed in architectural woodwork.

4. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
5. Apply WI-certified compliance label to first page of Shop Drawings.

D. Samples for Initial Selection:

1. Shop-applied transparent finishes.
2. Shop-applied opaque finishes.
3. Plastic laminates.
4. PVC edge material.
5. Thermoset decorative panels.
6. Solid-surfacing materials.

E. Samples for Verification:

1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish, and specified edge material applied to 1 edge sample.
2. Thermoset decorative-panels, 8 by 10 inches, for each type, color, pattern, and surface finish, with edge banding on 1 edge.
3. Solid-surfacing materials, 6 inches square.
4. Exposed cabinet hardware and accessories, one unit for each type and finish.

F. Product Certificates: For each type of product, signed by product manufacturer.

G. Qualification Data: For Installer and fabricator.

## 1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance. Shop is a certified participant in AWI's Quality Certification Program.
- B. Installer Qualifications: Certified participant in AWI's Quality Certification Program.
- C. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.
- D. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

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

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.
- B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  - 1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
  - 2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.
- B. Hardware Coordination: Distribute copies of approved hardware schedule specified in Division 08 Section "Door Hardware (Scheduled by Describing Products)" to fabricator of architectural woodwork; coordinate Shop Drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS

2.1 WOODWORK / CASEWORK FABRICATORS

- A. Fabricators: Subject to compliance with requirements, provide interior architectural woodwork by one of the following:
  - a. Creative Associates.

- b. Alpine
- c. JB Millworks
- d. Benchmark Construction Services
- e. KS Wood Products
- f. Bills Custom Woodworks
- g. Grace Cabinet Shop
- e. Dakota Cabinet Company
- f. Other General Contractor/Architect approved casework fabricator.

## 2.2 MATERIALS

- A. General: Provide materials that comply with requirements of AWI's quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Wood Products: Comply with the following:
  - 1. Recycled Content of Medium-Density Fiberboard and Particleboard: Provide products with an average recycled content so postconsumer recycled content plus one-half of pre-consumer recycled content which meets the physical properties of ANSI A208.2-1009, Grade 155, manufactured with a formaldehyde-free adhesive system.
  - 2. Hardboard: AHA A135.4.
  - 3. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
  - 4. Particleboard: ANSI A208.1, Grade M-2.
  - 5. Softwood Plywood: DOC PS 1, Medium Density Overlay.
  - 6. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.
- C. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper complying with LMA SAT-1.
  - 1. Provide PVC or polyester edge banding complying with LMA EDG-1 on components with exposed or semi-exposed edges.
- D. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering high-pressure decorative laminates that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:
    - a. Abet Laminati, Inc.
    - b. Arborite; Division of ITW Canada, Inc.
    - c. Formica Corporation.
    - d. Lamin-Art, Inc.
    - e. Nevamar Company, LLC; Decorative Products Div.

- f. Panolam Industries International Incorporated.
  - g. Westinghouse Electric Corp.; Specialty Products Div.
  - h. Wilsonart International; Div. of Premark International, Inc.
  - i. Other, as may be Scheduled on Drawings.
- E. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.
  - 1. Manufacturers: Subject to compliance with requirements, provide products as indicated on Drawings and Finish Schedules or equivalent products by one of the following:
    - a. ABA Industries.
    - b. Avonite, Inc.
    - c. E. I. du Pont de Nemours and Company.
    - d. Formica Corporation.
    - e. LG Chemical, Ltd.
    - f. Meganite Inc.; a division of the Pyrochem Group.
    - g. Nevamar Company, LLC; Decorative Products Div.
    - h. Samsung; Cheil Industries Inc.
    - i. Swan Corporation (The).
    - j. Transolid, Inc.
    - k. Wilsonart International; Div. of Premark International, Inc.
    - l. Other, as may be Scheduled on Drawings.
  - 2. Type: Standard type, unless Special Purpose type is indicated. Match type as indicated on specified products on Drawings and Finish Schedules.
  - 3. Colors and Patterns: Match colors/patterns as indicated on specified products on Drawings and Finish Schedules.

## 2.3 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 08 Section "Door Hardware (Scheduled by Describing Products)."
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening.
- C. Pulls: Back mounted. ***See Drawings and Finish Schedules for finish/type.***
- D. Catches: Magnetic catches, BHMA A156.9, B03141 or Roller catches, BHMA A156.9, B03071. Provide 2 catches on doors over 4 feet high.
- E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04102; with shelf brackets, B04112.
- F. Shelf Rests: BHMA A156.9, B04013; metal.
- G. Drawer Slides: BHMA A156.9, B05091.

1. Heavy Duty (Grade 1HD-100): Side mounted; full-overtravel-extension type; zinc-plated steel ball-bearing slides.
  2. Box Drawer Slides: Grade 1HD-100; for drawers not more than 6 inches high and 24 inches wide.
  3. File Drawer Slides: Grade 1HD-200; for drawers more than 6 inches high or 24 inches wide.
  4. Pencil Drawer Slides: Grade 2; for drawers not more than 3 inches high and 24 inches wide.
  5. Trash Bin Slides: Grade 1HD-100; for trash bins not more than 20 inches high and 16 inches wide.
- H. Aluminum Slides for Sliding Glass Doors (if indicated on Drawings): BHMA A156.9, B07063.
- I. Door Locks (if indicated on Drawings): BHMA A156.11, E07121.
- J. Drawer Locks (if indicated on Drawings): BHMA A156.11, E07041.
- K. Grommets for Cable Passage through Countertops: 2-inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.
1. Product: Subject to compliance with requirements, provide "TG series" by Doug Mockett & Company, Inc. or equivalent.
- L. Paper Slots (if indicated on Drawings): 12 inches long by 1-3/4 inches wide by 1 inch deep; black, molded-plastic, paper-slot liner with 1/4-inch lip.
1. Product: Subject to compliance with requirements, provide "Model CP-2" by Doug Mockett & Company, Inc. or equivalent.
- M. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
1. Satin Chromium Plated: BHMA 626 for brass or bronze base; BHMA 652 for steel base.
- N. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.
- 2.4 MISCELLANEOUS MATERIALS
- A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.
- C. Adhesives, General: Do not use adhesives that contain urea formaldehyde.



- D. VOC Limits for Installation Adhesives and Glues: Use installation adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
  - 1. Wood Glues: 30 g/L.
  - 2. Contact Adhesive: 250 g/L.
- E. Adhesive for Bonding Plastic Laminate: **Formaldehyde-free adhesive system.**
  - 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

## 2.5 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Unless otherwise indicated, provide Premium-grade interior woodwork complying with referenced quality standard.
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- D. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
  - 1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch Thick or Less: 1/16 inch.
  - 2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.
  - 3. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch.
- E. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
  - 1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
  - 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.
- F. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish.

## 2.6 PLASTIC-LAMINATE CABINETS

- A. Grade: AWI-Premium.
- B. AWI Type of Cabinet Construction: Full Flush overlay.
- C. Reveal Dimension: 1/8 inch.
- D. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
  1. Horizontal Surfaces Other Than Tops: Standard.
  2. Postformed Surfaces: Grade HGP.
  3. Vertical Surfaces: Grade VGS.
  4. Edges: Plastic laminate self-edge, matching face laminate in color, pattern, and finish.
- E. Materials for Semiexposed Surfaces:
  1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS.
    - a. Edges of Plastic-Laminate Shelves: Plastic laminate self-edge, matching face laminate in color, pattern, and finish..
    - b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS
  2. Drawer Sides and Backs: Thermoset decorative panels – match color throughout.
  3. Drawer Bottoms: Thermoset decorative panels – match color throughout.
- F. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.
- G. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
  1. Match colors/patterns as indicated on specified products on Drawings and Finish Schedules.
- H. Provide dust panels of 1/4-inch plywood or tempered hardboard above compartments and drawers, unless located directly under tops.

## 2.7 PLASTIC-LAMINATE COUNTERTOPS

- A. Grade: Premium.
- B. High-Pressure Decorative Laminate Grade: HGS.

- C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
  - 1. Match colors/patterns as indicated on specified products on Drawings and Finish Schedules.
- D. Grain Direction: Parallel to cabinet fronts.
- E. Edge Treatment: Same as laminate cladding on horizontal surfaces.
- F. Core Material: Formaldehyde free Particleboard or medium-density fiberboard.
- G. Core Material at Sinks: Formaldehyde free Particleboard or medium-density fiberboard or exterior-grade plywood.
- H. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of countertop substrate.

## 2.8 SOLID-SURFACING-MATERIAL COUNTERTOPS

- A. Grade: Premium.
- B. Solid-Surfacing-Material Thickness: See specified products for thickness; see Drawing Details and Finish Schedules also.
- C. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:
  - 1. Match colors/patterns/finishes as indicated on specified products on Drawings and Finish Schedules.
- D. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
  - 1. Fabricate tops with shop-applied edges of materials and configuration indicated.
  - 2. Fabricate tops with loose backsplashes for field application.
- E. Install integral sink bowls in countertops in shop.
- F. Drill holes in countertops for plumbing fittings and soap dispensers in shop.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

### 3.2 INSTALLATION

- A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.
- B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.
- C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.
- F. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- G. Railings:
  - 1. General: Install rails with no more than 1/8 inch in 96-inch variation from a straight line.
  - 2. Stair Rails: Glue and dowel or pin balusters to treads and railings, and railings to newel posts.
  - 3. Wall Rails: Support rails on indicated metal brackets securely fastened to wall framing.
    - a. Space rail brackets not more than 6'-0" o.c.
- H. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
  - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
  - 2. Maintain veneer sequence matching of cabinets with transparent finish.
  - 3. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips and/or No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.
- I. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.

1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
  2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
  3. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.
  4. Calk space between backsplash and wall with sealant specified in Division 07 Section "Joint Sealants."
- J. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

### 3.3 ADJUSTING AND CLEANING

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

**END OF SECTION 064023**

## **SECTION 072100 - THERMAL INSULATION**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Perimeter insulation under slabs-on-grade.
  - 2. Perimeter wall insulation (supporting backfill).
  - 3. Concealed building insulation (See Drawings for locations – Foamed in Place Insulation specified elsewhere).
  - 4. Sound attenuation insulation.
- B. Related Sections include the following:
  - 1. Division 06 Section "Sheathing" for foam-plastic board sheathing over wood framing.
  - 2. Division 07 Section "Self-Adhering Sheet Waterproofing" for insulation and insulated drainage panels installed with waterproofing.
  - 3. Division 07 Section "Water-Drainage Exterior Insulation and Finish System (EIFS)" for insulation specified as part of these systems.
  - 4. Division 07 Section "Thermoplastic Membrane Roofing" for insulation specified as part of roofing construction.
  - 5. Division 09 Section "Gypsum Board" for installation in metal-framed assemblies of insulation specified by referencing this Section.
  - 6. Division 22 Section "Plumbing Insulation."
  - 7. Division 23 Section "HVAC Insulation."

#### **1.3 DEFINITIONS**

- A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

#### **1.4 PERFORMANCE REQUIREMENTS**

- A. Plenum Rating: Provide glass-fiber insulation where indicated in ceiling plenums whose test performance is rated as follows for use in plenums as determined by testing identical products per "Erosion Test" and "Mold Growth and Humidity Test" described in UL 181, or on comparable tests from another standard acceptable to authorities having jurisdiction.

1. Erosion Test Results: Insulation shows no visible evidence of cracking, flaking, peeling, or delamination of interior surface of duct assembly, after testing for 4 hours at 2500-fpm air velocity.
2. Mold Growth and Humidity Test Results: Insulation shows no evidence of mold growth, delamination, or other deterioration due to the effects of high humidity, after inoculation with *Chaetomium globosum* on all surfaces and storing for 60 days at 100 percent relative humidity in the dark.

#### 1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency for insulation products.

#### 1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.
- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
  1. Surface-Burning Characteristics: ASTM E 84.
  2. Fire-Resistance Ratings: ASTM E 119.
  3. Combustion Characteristics: ASTM E 136.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

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

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

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

### 2.2 FOAM-PLASTIC BOARD INSULATION

- A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively:
1. Available Manufacturers:
    - a. DiversiFoam Products.
    - b. Dow Chemical Company.
    - c. Owens Corning.
    - d. Pactiv Building Products Division.
  2. Type VI, 1.80 lb/cu. ft.
  3. If not indicated, provide at minimum and 24” back under slab at foundation a minimum 24” deep.
- B. Molded-Polystyrene Board Insulation: ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively:
1. Available Manufacturers:
    - a. DiversiFoam Products.
    - b. Manufacturers with a third-party certification program satisfying model building code mandatory requirements for foam plastics.
  2. Type VIII, 1.15 lb/cu. ft..

### 2.3 GLASS-FIBER BLANKET INSULATION

- A. Available Manufacturers:
1. CertainTeed Corporation.
  2. Guardian Fiberglass, Inc.
  3. Johns Manville.
  4. Knauf Fiber Glass.



5. Owens Corning.

- B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- C. Faced, Glass-Fiber Blanket Insulation: ASTM C 665, Type III (blankets with reflective membrane facing), Class A (membrane-faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier), faced with foil-scrim-kraft or foil-scrim-polyethylene vapor-retarder membrane on 1 face.
- D. Where glass-fiber blanket insulation is indicated by the following thicknesses, provide blankets in batt or roll form with thermal resistances indicated:
  - 1. **3-1/2 inches** thick with a thermal resistance of **R-15**.
  - 2. **3-5/8 inches** thick with a thermal resistance of **R-15**.
  - 3. **5-1/2 inches** thick with a thermal resistance of **R-21**.
  - 4. **6-1/2 inches** thick with a thermal resistance of **R-19**.

2.4 VAPOR RETARDERS (ONLY WHERE/IF INDICATED ON DRAWINGS)

- A. Polyethylene Vapor Retarders: ASTM D 4397, 10 mils thick. Vapor barriers under slabs is specified in Structural Foundation Drawings and/or in Section 033000.
- B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- C. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.

2.5 AUXILIARY INSULATING MATERIALS

- A. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by insulation manufacturers for sealing joints and penetrations in vapor-retarder facings.
- B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.
- C. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.

2.6 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:

1. Available Products:
    - a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
    - b. Eckel Industries of Canada; Stic-Klip Type N Fasteners.
    - c. Gemco; Spindle Type.
  2. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  3. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.
- B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:
1. Available Products:
    - a. Gemco; 90-Degree Insulation Hangers.
  2. Angle: Formed from 0.030-inch- thick, perforated, galvanized carbon-steel sheet with each leg 2 inches square.
  3. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.
- C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
1. Available Products:
    - a. AGM Industries, Inc.; RC150.
    - b. AGM Industries, Inc.; SC150.
    - c. Gemco; Dome-Cap.
    - d. Gemco; R-150.
    - e. Gemco; S-150.
  2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
    - a. Crawlspace.
    - b. Ceiling plenums.
    - c. Attic spaces.
    - d. Where indicated.
- D. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.
1. Available Products:
    - a. AGM Industries, Inc.; TACTOO Adhesive.

- b. Eckel Industries of Canada; Stic-Klip Type S Adhesive.
- c. Gemco; Tuff Bond Hanger Adhesive.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

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

#### 3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- E. For preformed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

#### 3.4 INSTALLATION OF PERIMETER AND UNDER-SLAB INSULATION

- A. On vertical surfaces, set insulation units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.

1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
- C. Protect below-grade insulation on vertical surfaces from damage during backfilling by applying protection course with joints butted. Set in adhesive according to insulation manufacturer's written instructions.
- D. Protect top surface of horizontal insulation from damage during concrete work by applying protection course with joints butted.

### 3.5 INSTALLATION OF GENERAL BUILDING INSULATION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Seal joints between foam-plastic insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.
- C. Set vapor-retarder-faced units with vapor retarder in location indicated of construction, unless otherwise indicated.
  1. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.
- D. Install mineral-fiber insulation in cavities formed by framing members according to the following requirements:
  1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
  2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
  3. Maintain 3-inch clearance of insulation around recessed lighting fixtures.
  4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
  5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
  6. For wood-framed construction, install mineral-fiber blankets according to ASTM C 1320 and as follows:
    - a. With faced blankets having stapling flanges, secure insulation by inset, stapling flanges to sides of framing members.

- b. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material is installed over it.
- E. Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
  - 1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application indicated.
  - 2. Apply insulation standoffs to each spindle to create cavity width indicated between concrete substrate and insulation.
  - 3. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation below indicated thickness.
  - 4. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.
- F. Install board insulation in curtain-wall construction where indicated on Drawings according to curtain-wall manufacturer's written instructions.
  - 1. Retain insulation in place by metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass. Maintain cavity width of dimension indicated between insulation and glass.
  - 2. Install insulation where it contacts perimeter fire-containment system to prevent insulation from bowing under pressure from perimeter fire-containment system.
- G. Stuff glass-fiber loose-fill insulation into miscellaneous voids and cavity spaces where shown. Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..

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

- A. Install unfaced glass-fiber blanket insulation over suspended ceilings (ONLY WHERE INDICATED ON DRAWINGS) at partitions in a width that extends insulation 48 inches on either side of partition. Thickness of insulation as indicated on Drawings.

### 3.7 INSTALLATION OF VAPOR RETARDERS (ONLY WHERE/IF INDICATED ON DRAWINGS)

- A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

- B. Seal vertical joints in vapor retarders over framing by lapping not less than two wall studs. Fasten vapor retarders to wood framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches o.c.
- C. Before installing vapor retarder, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
- D. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.
- E. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.
- F. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

### 3.8 PROTECTION

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

**END OF SECTION 072100**

## **SECTION 079200 - JOINT SEALANTS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Completely close with sealant all joints. Work includes joints between precast/tilt-up wall panels, joints around frames of doors, louvers, or other openings in exterior walls, flooring joints, joints at penetrations of walls, decks, and floors by piping and other services and equipment, joints between items of equipment and other construction, and other joints indicated or specified to be sealed.

#### **1.3 SYSTEM PERFORMANCE REQUIREMENTS**

- A. Provide elastomeric joint sealants that have been produced and installed to establish and to maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.
- B. Provide joint sealants for interior applications that have been produced and installed to establish and maintain airtight continuous seals that are water resistant and cause no staining or deterioration of joint substrates.

#### **1.4 SUBMITTALS**

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data from manufacturers for each joint sealant product required.
- C. Samples for initial selection purposes in form of manufacturer's standard bead samples, consisting of strips of actual products showing full range of colors available, for each product exposed to view.
  - 1. Provide minimum three (3) sample cards.

#### **1.5 QUALITY ASSURANCE**

- A. Single Source Responsibility for Joint Sealer Materials: Obtain joint sealer materials from a single manufacturer for each different product required.
- B. Product Testing: Provide comprehensive test data for each type of joint sealer based on tests conducted by a qualified independent testing laboratory on current product formulations within a 24-month period preceding date of Contractor's submittal of test results to Architect.
  - 1. Test elastomeric sealants for compliance with requirements specified by reference to ASTM C 920. Include test results for hardness, stain resistance, adhesion and cohesion under cyclic movement (per ASTM C 719), low-temperature flexibility, modulus of elasticity at 100 percent strain, effects of heat aging, and effects of accelerated weathering.
- C. Installer must be trained and provide certificates from product manufacturer.

#### **1.6 DELIVERY, STORAGE, AND HANDLING:**

- A. Deliver materials to Project site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.

- B. Store and handle materials in compliance with manufacturers' recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

#### 1.7 PROJECT CONDITIONS

- A. Environmental Conditions: Do not proceed with installation of joint sealers under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealer manufacturers.
  - 2. When joint substrates are wet due to rain, frost, condensation, or other causes.
- B. Joint Width Conditions: Do not proceed with installation of joint sealers where joint widths are less than allowed by joint sealer manufacturer for application indicated.
- C. Joint Substrate Conditions: Do not proceed with installation of joint sealers until contaminants capable of interfering with their adhesion are removed from joint substrates.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealers, joint fillers and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Colors: Provide color of exposed joint sealers indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors.

#### 2.2 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated which complies with ASTM C 920 requirements, including those referenced for Type, Grade, Class, and Uses.
- B. One-Part Nonsag Urethane Sealant: Type S; Grade NS; Class 25; and Uses NT, M, A, and, as applicable to joint substrates indicated, O.
- C. One-Part Pourable Urethane Sealant: Type S, Grade P, Class 25, and complying with the following requirements for Uses:
  - 1. Uses T, M and, as applicable to joint substrates indicated, O.
- D. Available Products: Subject to compliance with requirements, elastomeric sealants which may be incorporated in the Work include, but are not limited to, the following:
  - 1. One-Part Nonsag Urethane Sealant for Use NT:
    - a. "Sikaflex-1a"; Sika Corp.
    - b. "Sikaflex-15LM"; Sika Corp.
    - c. "Dymonic"; Tremco, Inc.
  - 2. One-Part Pourable Urethane Sealant for Use T:
    - a. "Vulkem 45"; Mameco International, Inc.
    - b. "Sonolastic SL-1"; Sonneborn Building Products Div., Rexnord Chemical Products Inc.

#### 2.3 LATEX JOINT SEALANTS

- A. Acrylic-Emulsion Sealant: Manufacturer's standard, one part, nonsag, mildew-resistant, acrylic-emulsion sealant complying with ASTM C 834, formulated to be paintable and recommended for exposed applications on interior and on protected exterior locations involving joint movement of



not more than plus or minus 5 percent.

- B. Available Products: Subject to compliance with requirements, latex joint sealants which may be incorporated in the Work include, but are not limited to, the following:
  - 1. Acrylic-Emulsion Sealant:
    - a. "AC-20"; Pecora Corp.
    - b. "Tremco Acrylic Latex 834"; Tremco Inc.

#### 2.4 MISCELLANEOUS JOINT SEALANTS

- A. Acoustical Sealant for Concealed Joints: Manufacturer's standard, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound.
- B. Available Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:
  - 1. Acoustical Sealants for Concealed Joints:
    - a. "BA-98"; Pecora Corp.
    - b. "Tremco Acoustical Sealant"; Tremco Inc.

#### 2.5 FIRE-RESISTANT JOINT SEALERS

- A. General: Provide manufacturer's standard fire-stopping sealant, with accessory materials, having fire-resistance ratings indicated as established by testing identical assemblies per ASTM E 814 by Underwriters Laboratory, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction.
- B. Foamed-In-Place Fire-Stopping Sealant: Two-part, foamed-in-place, silicone sealant formulated for use in a through-penetration fire-stop system for filling openings around cables, conduit, pipes and similar penetrations through walls and floors.
- C. One-Part Fire-Stopping Sealant: One part elastomeric sealant formulated for use in a through-penetration fire-stop system for sealing openings around cables, conduit, pipes and similar penetrations through walls and floors.
- D. Available Products: Subject to compliance with requirements, products which may be incorporated in the Work include, but are not limited to, the following:
  - 1. Foamed-In-Place Fire-Stopping Sealant:
    - a. "Dow Corning Fire Stop Foam"; Dow Corning Corp.
    - b. "Pensil 851"; General Electric Co.
  - 2. One-Part Fire-Stopping Sealant:
    - a. "Dow Corning Fire Stop Sealant"; Dow Corning Corp.
    - b. "Hilti" - Fire Sealant.

#### 2.6 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material and type which are nonstaining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonwaxing, nonextruding strips of flexible, nongassing plastic foam of material indicated below; nonabsorbent to water and gas; and of size, shape and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
  - 1. Closed-cell soft rod, unless otherwise indicated, subject to approval of sealant manufacturer,

for cold-applied sealants only.

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

## 2.7 MISCELLANEOUS MATERIALS

- A. Primer: Provide type recommended by joint sealer manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealer-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Provide nonstaining, chemical cleaners of type which are acceptable to manufacturers of sealants and sealant backing materials, which are not harmful to substrates and adjacent nonporous materials, and which do not leave oily residues or otherwise have a detrimental effect on sealant adhesion or in-service performance.
- C. Masking Tape: Provide nonstaining, nonabsorbent type compatible with joint sealants and to surfaces adjacent to joints.
- D. Accessory Materials for Fire-Stopping Sealants: Provide forming, joint fillers, packing and other accessory materials required for installation of fire-stopping sealants as applicable to installation conditions indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealers, with Installer present, for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealer performance. Do not proceed with installation of joint sealers until unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealers to comply with recommendations of joint sealer manufacturers and the following requirements:
  - 1. Remove all foreign material from joint substrates which could interfere with adhesion of joint sealer, including dust; paints, except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer; old joint sealers; oil; grease; waterproofing; water repellants; water; surface dirt; and frost.
  - 2. Clean concrete, masonry, unglazed surfaces of ceramic tile and similar porous joint substrate surfaces, by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealers. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
  - 3. Remove laitance and form release agents from concrete.
  - 4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile; and other nonporous surfaces by chemical cleaners or other means which are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealers.
- B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealer manufacturer based on preconstruction joint sealer-substrate tests or prior experience. Apply primer to comply with joint sealer manufacturer's recommendations. Confine primers to areas of joint sealer bond, do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining

surfaces which 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 SEALERS

- A. General: Comply with joint sealer manufacturers' printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.
- B. Elastomeric Sealant Installation Standard: Comply with recommendations of ASTM C 962 for use of joint sealants as applicable to materials, applications and conditions indicated.
- C. Latex Sealant Installation Standard: Comply with requirements of ASTM C 790 for use of latex sealants.
- D. Acoustical Sealant Application Standard: Comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
- E. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:
  - 1. Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths which allow optimum sealant movement capability.
    - a. Do not leave gaps between ends of joint fillers.
    - b. Do not stretch, twist, puncture, or tear joint fillers.
    - c. Remove absorbent joint fillers which have become wet prior to sealant application and replace with dry material, or allow material to dry completely.
  - 2. Install bond breaker tape between sealants and joint fillers, compression seals, or back of joints where adhesion of sealant to surfaces at back of joints would result in sealant failure.
- F. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths which allow optimum sealant movement capability.
- G. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
  - 1. Provide concave joint configuration per Figure 6A in ASTM C 962, unless otherwise indicated.
  - 2. Provide Recessed joint configuration per Figure 6C in ASTM C 962, of recess depth and at locations indicated.
- H. Installation of Fire-Stopping Sealant: Install sealant, including forming, packing, and other accessory materials to fill openings around mechanical and electrical services penetrating floors and walls to provide fire-stops with fire resistance ratings indicated for floor or wall assembly in which penetration occurs. Comply with installation requirements established by testing and inspecting agency.

### 3.4 CLEANING

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

### 3.5 PROTECTION

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

### 3.6 JOINT SEALER SCHEDULE

JOINT SEALERS	DESCRIPTION OF JOINT CONSTRUCTION AND LOCATION WHERE SEALANT IS TYPICALLY APPLIED, BUT NOT LIMITED TO: (SEE NOTES BELOW)
One-part Pourable Urethane Sealant	Exterior and interior joints in horizontal surfaces of concrete; joint between slab on grade and tilt-up concrete wall panel; between metal and concrete, mortar, and masonry; all slab on grade saw, control and construction joints shall be treated as outlined in spec section 033000.
One-part Nonsag Urethane Sealant	Exterior and interior joints in vertical surfaces of concrete and masonry; between concrete masonry or stone; between metal and concrete, mortar, or stone; perimeters of metal frames in exterior walls; exterior windows & door frames; where indicated on Drawings; overhead or ceiling joints unless otherwise specified in other specification sections.
Acrylic-Emulsion Sealant	Interior joints in field-painted vertical and overhead surfaces at perimeter of elevator door frames, hollow metal door frames, gypsum drywall, plaster and concrete or concrete masonry, and all other interior locations not indicated otherwise. See Drawings & Details for locations also.

Note: Install sealant indicated in joints fitting descriptions and locations listed.

**END OF SECTION 079200**

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

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Extend of Standard hollow metal doors and frames indicated on Drawings & Schedules.
- B. Related Sections:
  - 1. Division 08 Section "Door Hardware" for door hardware for hollow metal doors.
  - 2. Division 09 Sections "Painting" for field painting hollow metal doors and frames.
  - 3. Division 26 Sections for electrical connections including conduit and wiring for door controls and operators. Refer to Electrical Drawings as well.

#### **1.3 DEFINITIONS**

- A. Minimum Thickness: Minimum thickness of base metal without coatings.
- B. Standard Hollow Metal Work: Hollow metal work fabricated according to ANSI/SDI A250.8.
- C. Custom Hollow Metal Work: Hollow metal work fabricated according to ANSI/NAAMM-HMMA 861.

#### **1.4 SUBMITTALS**

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, fire-resistance rating, temperature-rise ratings, and finishes.
- B. Shop Drawings: Include the following:
  - 1. Elevations of each door design.
  - 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
  - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
  - 4. Locations of reinforcement and preparations for hardware.
  - 5. Details of each different wall opening condition.
  - 6. Details of anchorages, joints, field splices, and connections.

7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Other Action Submittals:

1. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

E. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of hollow metal door and frame assembly.

## 1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252 or UL 10B, UL 10C.

1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.

C. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.

D. Smoke-Control Door Assemblies: Comply with NFPA 105 or UL 1784.

E. Preinstallation Conference: Conduct conference at Project site.

## 1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.

1. Provide additional protection to prevent damage to finish of factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch-high wood blocking. Do not store in a manner that traps excess humidity.
1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

#### 1.7 PROJECT CONDITIONS

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

#### 1.8 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  1. Amweld Building Products, LLC.
  2. Benchmark; a division of Therma-Tru Corporation.
  3. Ceco Door Products; an Assa Abloy Group company.
  4. Curries Company; an Assa Abloy Group company.
  5. Deansteel Manufacturing Company, Inc.
  6. Firedoor Corporation.
  7. Fleming Door Products Ltd.; an Assa Abloy Group company.
  8. Habersham Metal Products Company.
  9. Karpen Steel Custom Doors & Frames.
  10. Kewanee Corporation (The).
  11. Mesker Door Inc.
  12. Pioneer Industries, Inc.
  13. Security Metal Products Corp.
  14. Steelcraft; an Ingersoll-Rand company.
  15. Windsor Republic Doors.

16. Members of the Steel Door Institute (SDI Members).

## 2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.
  1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dipped galvanized according to ASTM A 153/A 153M, Class B.
- C. Inserts, Bolts, and Fasteners: Hot-dipped galvanized according to ASTM A 153/A 153M.
- D. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.
- E. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.
- F. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- G. Glazing: Comply with requirements in Division 08 Section "Glazing."
- H. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

## 2.3 STANDARD HOLLOW METAL DOORS

- A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8.
  1. Design: Flush panel.
  2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, polyisocyanurate, mineral-board, or vertical steel-stiffener core.
    - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.



- b. Thermal-Rated (Insulated) Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than R-6.35 when tested according to ASTM C 1363.
            - 1) Locations: Exterior doors and interior doors where indicated.
  - 3. Vertical Edges for Single-Acting Doors: Beveled edge.
    - a. Beveled Edge: 1/8 inch in 2 inches.
  - 4. Vertical Edges for Double-Acting Doors: Round vertical edges with 2-1/8-inch radius.
  - 5. Top and Bottom Edges: Closed with flush or inverted 0.042-inch thick, end closures or channels of same material as face sheets.
  - 6. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
  - 7. All doors must have bevel edges.
  - 8. All doors must be set up for and reinforced for specified hardware.
  - 9. Doors must be of the same manufacturer as frames.
- B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
- 1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless).
    - a. Width: 1-3/4 inches min. or as indicated on Drawings.
    - b. Minimum 16-gauge faces, A-60 galvanized cold rolled steel.
    - c. Bonded polystyrene insulating cores.
    - d. Provide fire rated door assemblies where scheduled bearing U.L. labels for specific rating.
    - e. Provide flush top cap at all exterior doors.
- C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
- 1. Level 2 and Physical Performance Level B (Heavy Duty), Model 1 (Full Flush)
    - a. Width: 1-3/4 inches min. or as indicated on Drawings.
    - b. Minimum 18-gauge faces.
    - c. Bonded honeycomb cores.
    - d. Provide fire rated door assemblies where scheduled bearing U.L. labels for specific rating.
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- E. Fabricate faces of doors, panels, and frames, including stiles and rails of non-flush units, from only cold-rolled steel sheet.

- F. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.
- G. Fabricate exterior doors, panels, and frames from galvanized sheet steel. Close top and bottom edges of exterior doors as integral part of door construction or by addition of minimum 16-gage inverted steel channels. Exterior doors shall be seamless construction. All joints shall be welded and filled so no visible edge joints are exposed to weather. All exterior doors must have a flush top cap. All butt hinge reinforcements to be 6 gage.

## 2.4 STANDARD HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
  - 1. Knock down type frames are permitted – field verify existing ‘Timely’ frames to match.
  - 2. Do not use friction fit drywall frames. All frames shall be permanently anchored.
  - 3. Door Silencers: Except on weatherstripped frames, drill stops to receive 3 silencers on strike jambs of single-swing frames and 2 silencers on heads of double-swing frames.
  - 4. Plaster Guards: Provide 26 gage steel plaster guards or mortar boxes, welded to frame, at back of finish hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.
- B. Exterior Frames: Fabricated from metallic-coated steel sheet.
  - 1. Fabricate frames with mitered or coped corners.
  - 2. Fabricate frames as full welded.
  - 3. Frames for Level 3 Steel Doors: 0.053-inch thick steel sheet.
  - 4. Minimum 14 gage, A60 galvanized cold rolled steel.
  - 5. Provide fire rated door assemblies where scheduled bearing U.L. labels for specific rating.
- C. Interior Frames: Fabricated from cold-rolled steel sheet.
  - 1. Fabricate frames with mitered or coped corners.
  - 2. Fabricate frames as full welded.
  - 3. Frames for Level 2 Steel Doors: 0.053-inch-thick steel sheet.
  - 4. Frames for Wood Doors: Min. 16-gauge thick steel sheet.
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames. All frames shall be properly reinforced for required hardware – see Hardware Schedule.
- E. All butt hinge reinforcements to be 6 gage.

## 2.5 FRAME ANCHORS

- A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
  2. Stud-Wall Type: Designed to engage stud; not less than 0.042 inch thick.
  3. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide stud anchor from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch thick, and as follows:
1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
  2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.

## 2.6 HOLLOW METAL PANELS

- A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.

## 2.7 STOPS AND MOLDINGS

- A. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.

## 2.8 LOUVERS

- A. Provide louvers for interior doors, where indicated, that comply with SDI 111C, with blades or baffles formed of 0.020-inch thick, cold-rolled steel sheet set into 0.032-inch-thick steel frame.
1. Sightproof Louver: Stationary louvers constructed with inverted V-shaped or Y-shaped blades.
  2. Fire-Rated Automatic Louvers (if indicated): Louvers constructed with movable blades closed by actuating fusible link and listed and labeled for use in fire-rated door assemblies of type and fire-resistance rating indicated by same testing and inspecting agency that established fire-resistance rating of door assembly.

## 2.9 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.

2.10 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117, ANSI/NAAMM-HMMA 861.
- C. Hollow Metal Doors:
  - 1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
  - 2. Glazed Lites: Factory cut openings in doors.
  - 3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
- D. Hollow Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
  - 1. Welded Frames: Weld flush face joint; grind, fill, dress, and make smooth, flush, and invisible.
  - 2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
  - 3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
  - 4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
  - 5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
  - 6. Jamb Anchors: Provide number and spacing of anchors as follows:
    - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      - 1) Two anchors per jamb up to 60 inches high.
      - 2) Three anchors per jamb from 60 to 90 inches high.
      - 3) Four anchors per jamb from 90 to 120 inches high.
      - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
    - b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      - 1) Three anchors per jamb up to 60 inches high.

- 2) Four anchors per jamb from 60 to 90 inches high.
  - 3) Five anchors per jamb from 90 to 96 inches high.
  - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
  - 5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.
- c. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
  - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
  - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.
- F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
  1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8 or ANSI/NAAMM-HMMA 861.
  2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
  3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
  4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.
- G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
  1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow metal work.
  2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
  3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
  4. Provide loose stops and moldings on inside of hollow metal work.
  5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

## 2.11 STEEL FINISHES

- A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.
  - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
  - 1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
  - 2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
  - 3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
  - 4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.
- C. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

### 3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11.
  - 1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
    - a. At fire-protection-rated openings, install frames according to NFPA 80.
    - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    - c. Install frames with removable glazing stops located on secure side of opening.
    - d. Install door silencers in frames before grouting.
    - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    - f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    - g. Field apply bituminous coating to backs of frames that are filled with grout containing antifreezing agents.
  - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
    - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
  - 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
  - 4. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
  - 5. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
  - 6. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
  - 7. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
  - 8. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

- a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
    - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
  - 9. Framing contractor shall fasten metal studs to door/window jamb anchors.
  - C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
    - 1. Non-Fire-Rated Standard Steel Doors:
      - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
      - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
      - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
      - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
    - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
    - 3. Smoke-Control Doors: Install doors according to NFPA 105.
  - D. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.
    - 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.
- 3.4 ADJUSTING AND CLEANING
- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
  - B. Remove grout and other bonding material from hollow metal work immediately after installation.
  - C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
  - D. Metallic-Coated Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

**END OF SECTION 081113**



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

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Solid-core doors with wood-veneer faces.
  - 2. Factory finishing flush wood doors.
  - 3. Factory fitting flush wood doors to frames and factory machining for hardware.
- B. Related Sections:
  - 1. Division 08 Section "Glazing" for glass view panels in flush wood doors.

#### **1.3 SUBMITTALS**

- A. Product Data: For each type of door indicated. Include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.
  - 1. Indicate dimensions and locations of mortises and holes for hardware.
  - 2. Indicate dimensions and locations of cutouts.
  - 3. Indicate requirements for veneer matching.
  - 4. Indicate doors to be factory finished and finish requirements.
  - 5. Indicate fire-protection ratings for fire-rated doors.
- C. Samples for Initial Selection: For factory-finished doors.
- D. Samples for Verification:
  - 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.
  - 2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.

- a. Provide samples for each species of veneer and solid lumber required.
  - b. Finish veneer-faced door samples with same materials proposed for factory-finished doors.
- 3. Frames for light openings, 6 inches long, for each material, type, and finish required.
- E. Warranty: Submit sample of special warranty. See Section 1.7.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain flush wood doors and wood paneling from single manufacturer.
- B. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated," and WDMA I.S.1-A, "Architectural Wood Flush Doors."
- C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252.
  - 1. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.
- D. Preinstallation Conference: Conduct conference at Project site.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

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

#### 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

#### 1.7 WARRANTY

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

- a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
  - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: **Life of installation.**

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers:
  1. Algoma Hardwoods, Inc.
  2. Eggers Industries.
  3. Lambton Doors.
  4. Marshfield Door Systems, Inc.
  5. VT Industries Inc.

### 2.2 DOOR CONSTRUCTION, GENERAL

- A. Low-Emitting Materials: Provide doors made with adhesives and composite wood products that do not contain urea formaldehyde.
- B. WDMA I.S.1-A Performance Grade:
  1. Heavy Duty unless otherwise indicated.
- C. Particleboard-Core Doors:
  1. Particleboard: ANSI A208.1, Grade LD-1, made with binder containing no urea-formaldehyde resin.
  2. Blocking: Provide wood blocking in particleboard-core doors as follows:
    - a. 5-inch top-rail blocking, in doors indicated to have closers.
    - b. 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
    - c. 5-inch midrail blocking, in doors indicated to have exit devices.
  3. Provide doors with either glued-wood-stave or structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.
- D. Fire-Protection-Rated Doors: Provide core specified or mineral core as needed to provide fire-protection rating indicated.

1. Edge Construction: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
2. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.

E. Mineral-Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as follows:
  - a. 5-inch top-rail blocking.
  - b. 5-inch bottom-rail blocking, in doors indicated to have protection plates.
  - c. 5-inch midrail blocking, in doors indicated to have armor plates.
  - d. 5-inch midrail blocking, in doors indicated to have exit devices.
3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

2.3 VENEERED-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: **Premium, with Grade A faces.**
2. Species: **White Maple**
3. Cut: **Plain Sliced**
4. Finish: **Custom matched stain per Interior Finish Schedule**
5. Match between Veneer Leaves: **Book match.**
6. Assembly of Veneer Leaves on Door Faces: Running match.
7. Pair and Set Match: Provide for doors hung in same opening
8. Room Match: Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 20 feet or more.
9. Exposed Vertical and Top Edges: Same species as faces.
10. Core: Particleboard or solid wood block.
11. Construction: **Five plies.** Stiles and rails are bonded to core, then entire unit abrasive planed before veneering. Faces are bonded to core using a hot press.
12. WDMA I.S.1-A Performance Grade: **Heavy Duty.**
13. All doors shall be pre-machined for hardware supplied – see Hardware Schedule.

2.4 LOUVERS AND LIGHT FRAMES

A. Metal Louvers (where indicated):

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following available manufacturers:
  - a. Air Louvers Inc.
  - b. Anemostat; a Mestek company.
  - c. Hiawatha Incorporated.
  - d. L & L Louvers, Inc.
  - e. LL Building Products, Inc.; a division of GAF Materials Corporation.
  - f. Louvers & Dampers, Inc.; a Mestek company.
  - g. McGill Architectural Products.
  - h. National Guard Products.
2. Blade Type: Vision-proof, inverted V or Vision-proof, inverted Y.
3. Metal and Finish: Hot-dip galvanized steel, 0.040 inch thick, factory primed for paint finish.

- B. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch thick, cold-rolled steel sheet; factory primed for paint finish; and approved for use in doors of fire-protection rating indicated.

## 2.5 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
  1. Comply with requirements in NFPA 80 for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
  1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
  2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.
- C. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
  1. Fabricate door and transom panels with full-width, solid-lumber, rabbeted, meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.
- D. Openings: Cut and trim openings through doors in factory.
  1. Light Openings: Trim openings with moldings of material and profile indicated.

2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Division 08 Section "Glazing."
3. Louvers: Factory install louvers in prepared openings.

## 2.6 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
  1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on bottom edges, edges of cutouts, and mortises.
- B. Finish all wood doors at factory, unless noted otherwise.
- C. Transparent Finish:
  1. Grade: Premium.
  2. Finish: AWI 100% solid polyurethane (no VOC), system.
  3. ***Staining: Custom stain color to match Finish Schedules or sample provided by Architect. Doors shall be factory finished.***
  4. Effect: Semifilled finish.
  5. Sheen: Satin.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
  1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
  2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Hardware: For installation, see Division 08 Section "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
  1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

- C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
  - 1. Clearances: Provide 1/8 inch at heads, jambs, and between pairs of doors. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
    - a. Comply with NFPA 80 for fire-rated doors.
  - 2. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
  - 3. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.
- D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

### 3.3 PROTECTION

- A. Protect installed wood doors from damage or deterioration until acceptance of the work.
- B. Refinish or replace doors damaged during installation or by other trades.

### 3.4 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

**END OF SECTION 081416**

## **SECTION 083323 - OVERHEAD COILING DOORS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section includes:
  - 1. Non-rated, non-insulated, rolling/coiling door with manual push up operation.

#### **1.2 ACTION SUBMITTALS**

- A. Product Data: For each type and size of overhead coiling door and accessory.
- B. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 2. Show locations of replaceable fusible links.
  - 3. Wiring Diagrams: For power, signal, and control wiring.
  - 4. Fire rating classification based on specified rating.
- C. Samples: For each exposed product and for each color and texture specified.

#### **1.3 CLOSEOUT SUBMITTALS**

- A. Maintenance Data.

#### **1.4 QUALITY ASSURANCE**

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.
- B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at as close to neutral pressure as possible according to NFPA 252 or UL 10B.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.



## 1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
  - 1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
  - 2. Warranty Period for Overhead Coiling Doors: **Two (2) years minimum (parts and labor).**

## PART 2 - PRODUCTS

### 2.1 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
  - 1. Metal Interior Curtain-Slat Facing: Match metal of exterior curtain-slat face.
- B. Bottom Bar for Service Doors: Consisting of two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch (38 by 38 by 3 mm) thick; fabricated from metal to match curtain slats and finish.
- C. Astragal for Interior Doors: Equip each door bottom bar with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.
- D. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain.

### 2.2 HOOD

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
  - 1. Include automatic drop baffle on fire-rated doors to guard against passage of smoke or flame.

### 2.3 CURTAIN ACCESSORIES

- A. Smoke Seals: Equip each fire-rated door with smoke-seal perimeter gaskets for smoke and draft control as required for door listing and labeling by a qualified testing agency.

- B. Push/Pull Handles: Equip each push-up-operated or emergency-operated door with lifting handles on each side of door, finished to match door.
- C. Automatic-Closing Device for Fire-Rated Doors: Equip each fire-rated door with an automatic-closing device that is inoperative during normal door operations and that has a governor unit complying with NFPA 80 and an easily tested and reset release mechanism designed to be activated by the following:
  - 1. Building fire-detection and alarm systems and manufacturer's standard door-holder-release devices.

## 2.4 COUNTERBALANCING MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

## 2.5 MANUAL DOOR OPERATORS

- A. Equip door with manufacturer's recommended manual door operator unless another type of door operator is indicated.
- B. Push-up Door Operation: Design counterbalance mechanism so required lift or pull for door operation does not exceed 25 lbf.

## 2.6 DOOR ASSEMBLY

- A. Counter Door: Overhead manual coiling counter shutter/door formed with curtain of interlocking metal slats.
  - 1. Basis of Design: Subject to compliance with requirements, provide the following Doors Scheduled or equivalent product from one of the following manufacturers listed below.
    - a. **Doors 136B**: Equal to: Overhead Door Co., Model 652, Interior – Face of Jamb Configuration, Non Fire-Rated, Rolling Clear Anodized Aluminum Counter Shutter/Door with manual push up *or hand crank operation based on door size/operation limitations of manufacturer* and all necessary components for a complete functioning fire door system.
      - 1) Finish: Clear Anodized Aluminum.
  - 2. Alternate Manufacturer's:
    - a. C.H.I. Overhead Doors.
    - b. Cookson Company.

- c. Cornell Iron Works, Inc.
  - d. McKeon Rolling Steel Door Company, Inc.
  - e. Overhead Door Corporation.
  - f. Raynor.
  - g. Wayne-Dalton Corp.
  - h. Windsor Door.
- B. Operation Cycles: Not less than 20,000.
- C. Fire Rating: As/if scheduled on Drawings – See Door Schedule.
- D. Door Curtain Material: Aluminum.
- E. Door Curtain Slats: Flat profile slats of 2-5/8-inch center-to-center height.
- F. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.
- G. Hood: Match curtain material and finish.
  - 1. Shape: Square.
  - 2. Mounting: Face of wall.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Fire-Rated Doors: Install according to NFPA 80.
- C. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion. Lubricate bearings and sliding parts as recommended by manufacturer.
- D. See wall sections and details for custom recessed hood cavity construction at Door 193. Coordinate final dimensions with framing and ceiling contractors for a proper fit.

#### 3.2 DEMONSTRATION

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

**END OF SECTION 083323**

## **SECTION 084113 - ALUMINUM WINDOWS, STOREFRONT, ENTRANCES AND DOORS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section includes:
  - 1. Aluminum doors and hardware complete.
  - 2. Aluminum framing and storefront systems, aluminum sills and associated break metal parts
- B. Related Sections; The following sections contain requirements that relate to this Section:
  - 1. Joint Sealers 079200.
  - 2. Glazing requirements in Section 088000.
  - 3. Section 087100 for lock cylinders.

#### **1.3 DEFINITIONS**

- A. Performance class number included as part of the window designation system is the actual design pressure in pounds per sq. ft. used to determine the structural test pressure and water test pressure.
  - 1. Structural test pressure, wind load test, is equivalent to 150 percent of the design pressure.
  - 2. Water leakage resistance test pressure is equivalent to 15 percent of the design pressure with 2.86 psf as a minimum.

#### **1.4 SYSTEM PERFORMANCE REQUIREMENTS**

- A. General: Provide aluminum units that comply with performance requirements specified, as demonstrated by testing manufacturer's corresponding stock systems according to test methods indicated.
- B. Design Requirements: Comply with structural performance, air infiltration, and water penetration requirements indicated in AAMA 101 for type, grade, and performance class of units required.
  - 1. Heights of window units above grade at the window centerline are indicated or can be determined from the drawings. Consult with the Architect for clarification needed to confirm required loading and test pressures.
  - 2. Design wind velocity at the project site is as specified in Structural Construction Documents.
  - 3. Provide aluminum systems including anchorages capable of withstanding wind load pressures calculated according to requirements of 2006 International Building Code or the American

Society of Civil Engineers ASCE “Minimum Design Loads for Buildings and Other Structures, whichever is more stringent.

#### 1.5 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of the Contract and Division 1 Specification Section 013000.
  - 1. Product data for each type of unit required, including:
  - 2. Shop drawings for each type of unit required. Include information not fully detailed in manufacturer's standard product data and the following:
    - a. Layout and installation details, including anchors.
    - b. Elevations of continuous work at 1/4-inch scale and typical elevations at 3/4-inch scale.
    - c. Section details of typical composite members, including reinforcement and attachment to building components.
    - d. Details of all field connections and anchorage fastening & sealing methods.
    - e. Profiles and dimensions of individual components.
    - f. Data on hardware, accessories, and finishes.
    - g. Anchors, joint system, expansion provisions, glazing and sealing details.
    - h. Hardware, including operators.
    - i. Glazing details.
    - j. Accessories.
  - 3. Samples for Initial Color Selection: Submit samples of each specified finish on 12-inch-long sections of frame members. Where finishes involve normal color variations, include sample sets showing the full range of variations expected.

#### 1.6 QUALITY ASSURANCE

- A. Standards: Requirements for aluminum windows, terminology and standards of performance, and fabrication workmanship are those specified and recommended in AAMA 101 and applicable general recommendations published by AAMA.
- B. Single-Source Responsibility: Provide all systems and components in this Spec. Section from one source and produced by a single manufacturer.
- C. Design Concept: The drawings indicate the size, profiles, and dimensional requirements of the aluminum systems required and are based on the specific type and model indicated. Aluminum systems by other manufacturers may be considered provided deviations in dimensions and profiles are insignificant and do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.
- D. Contractor's Experience: Contractor shall have minimum of five (5) years’ experience in similar installations/replacements.

#### 1.7 PROJECT CONDITIONS

- A. Field Measurements: Check actual openings and conditions by accurate field measurement before fabrication. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of work.

## 1.8 WARRANTY

- A. Aluminum Systems Warranty: Submit a written warranty, executed by the manufacturer and Contractor, agreeing to repair or replace units that fail in materials or workmanship within the specified warranty period. Failures include but are not necessarily limited to:
  - 1. Structural failures including excessive deflection, excessive leakage, or air infiltration.
  - 2. Faulty operation of sash and hardware.
  - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
- B. Warranty Period: 3 years after the date of Substantial Completion.
- C. Warranty Period for Finish: 5 years from date of substantial completion for resistance to fading, chalking and deterioration.
- D. The warranty shall not deprive the Owner of other rights or remedies that the Owner may have under other provisions of the Contract Documents and is in addition to and runs concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Kawneer systems are specified; equal products by EFCO are acceptable, providing requirements of this section are met and deviations in dimensions or profile are minor and do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.

### 2.2 FIXED WINDOWS AND STOREFRONT FRAMING

- A. **Exterior** windows and storefront framing as shown on drawings at **Door 114C** are based on **Kawneer, Flush Front 451T TriFab VersaGlaze, Screw Spline, Thermal Storefront System – See Drawings:** 2" face dimension, 4 ½" overall depth. Provide other framing sizes as may be indicated on the drawings. Glass placement: ***Match existing window glass placement.***
- C. **Interior** windows and storefront framing as/if shown on drawings are based on **Kawneer, Center Glazed, 450 (with Optional 2" Sightline) Storefront System – See Drawings:** 2" face dimension, 4 ½" overall depth. Provide other framing sizes as may be indicated on the drawings. Glass placement: ***Center.***
- C. Exterior Glazing: 1 inch insulated glazing meeting requirements specified in Section 088000. Provide tempered glazing where indicated on door and window schedule or as required by code.
- D. Interior Glazing: 1/4"-1/2" clear glass and tempered safety glazing where required by Code. Glazing thickness shall be based on glazing sizes on door/window elevations per manufacturer's

performance requirements. See window elevations/types.

E. Provide bottom rail as shown and head rail where shown.

***F. Provide manufacturer’s thermally broken sub sills with end dams at all exterior locations, whether indicated on Drawings or not.***

## 2.3 ALUMINUM DOORS & FRAMES

A. General: Doors and frames shall be same manufacturer as storefront system and window system. See Schedule this Section for specific doors and hardware requirements.

1. All doors shall be factory glazed.

B. Closers: Surface mounted, to meet ANSI specifications for accessible entrances; finish to match frame finish.

C. Weatherstripping: Provide manufacturer’s standard integral seals and stops in door and frame.

D. Door Frames shall be equal to **Kawneer, 350 Series, Medium Stile Entrance Doors** with glazing as scheduled. See 088000.

## 2.5 HARDWARE SCHEDULE FOR ALUMINUM DOORS

***Note: Contractor shall review all door hardware with Owner’s Representative and obtain written approval prior to submitting door hardware submittals for review.***

A. At Exterior Entry, Door No: **114C** (HCAP Opener Door):

1. Wide stile aluminum door equal to **Kawneer, Series 350, Medium Stile Entrance Doors** – Door Heights per Door Schedule/Types. Provide all standard and optional hardware as listed below and/or required for function indicated. Equal products are acceptable, providing requirements of this section are met and deviations in dimensions, color or profile do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer. Provide optional 10” bottom rails.
2. 1” Insulated glass per Glazing Types and Section 088000.
3. Rim Panics latch exit device – See Door Hardware Schedule - 008700. Color: Aluminum to match door/frame.
4. Electric Strikes are specified in Section 087100. Coordinate with hardware supplier for door/frame prep and setup.
5. Cylinders are specified in Section 087100 – Provide one lock cylinder, keyed alike.
6. Closers are specified in Section 087100. Coordinate with hardware supplier for door/frame prep and setup.
7. Manufacturer’s standard continuous geared hinges.
8. Weather seals by door manufacturer
9. Provide optional bottom rail weathering.
10. Stops are specified in Section 087100.
11. 6” ADA/ANSI compliant threshold: mill finish aluminum – width per door.
12. Automatic Opener System are specified in Section 087100. Provide all necessary components

for a complete working system.

13. Accessories: Provide all Aluminum sills, mullion covers, transom frame covers, break metal parts as shown, and other components as may be needed to complete the system. Also provide special shapes or filler sections as shown on drawings or for field conditions indicated on drawings. Identify all special shapes or filler sections on shop drawings for Architects review. Identify specific locations.
14. See electrical for low voltage power supply. Doors/frames shall be prepped for Owner/Vendor provided card access/magnetic lock system. Coordinate all door hardware with Owner’s Security Vendor for provided card access mag lock security systems at this door location for proper functioning. Adjust door hardware as required for successful integration of Owner’s magnetic lock/card access system at these doors.
15. Aluminum Finish Color: **Dark Bronze Anodized Aluminum** (match existing).

## 2.5 FINISHES AT ALUMINUM DOORS & WINDOWS

- A. Manufacturer’s standard **Dark Bronze Anodized Aluminum (Match Existing)**.
- B. General: Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.
- C. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.

## 2.6 ACCESSORIES

- A. Aluminum sills, mullion covers, transom frame covers, break metal parts as shown, and other components as may be needed to complete the system.
- B. Provide special shapes or filler sections as shown on drawings or for field conditions indicated on drawings. Identify all special shapes or filler sections on shop drawings for Architects review. Identify specific locations.

## 2.7 GLAZING

- A. See Section 088000 Glass and Glazing.
- B. Pre-glazed Fabrication: Systems may be pre-glazed window units at the factory where possible and practical for applications indicated. Comply with glass and glazing requirements of the "Glass and Glazing" sections of these specifications and AAMA 101.

## 2.8 FABRICATION

- A. General: Fabricate aluminum units to comply with indicated standards. Include a complete system for assembly of components and anchorage of window units.
  1. Provide units that are can be re-glazed without dismantling sash or ventilator framing.
- C. Prepare window sash or ventilators for glazing except where pre-glazing at the factory is indicated.



- D. All exposed work shall be matched to produce continuity of line & design with all joints such that raw edges will not be visible at joints.
- E. Thermal-Break Construction: Fabricate units with an integral concealed low-conductance thermal barrier, located between exterior materials and members exposed on the interior, in a manner that eliminates direct metal-to-metal contact.
  - 1. Provide hardware with low conductivity or nonmetallic material for hardware bridging thermal breaks at frame or vent sash.
  - 2. Weepholes: Provide weepholes and internal passages to conduct infiltrating water to the exterior.
  - 3. Mullions: Provide mullions and cover plates as shown, complete with anchors for support to structure and installation of units. Allow for erection tolerances and provide for movement of system due to thermal expansion and building deflections, in the manner indicated.
  - 4. Glazing Stops: Provide screw-applied or snap-on glazing stops, coordinated with glass selection and glazing system indicated. Finish glazing stops to match window and framing systems.

### PART 3 - EXECUTION

#### 3.1 INSPECTION

- A. Inspect openings before beginning installation. Verify that existing or new, rough or masonry opening, is correct and the sill condition is level.

#### 3.2 INSTALLATION

- A. Comply with manufacturer's specifications and recommendations for installation of framing, doors, and window units, hardware, operators, and other components of the work.
  - 1. Use care in erection so as not to mar, abrade, or stain finished surfaces.
- B. Set units plumb, level, and true to line, without warp or rack of frames or sash. Provide proper support and anchor securely in place.
  - 1. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials by complying with the requirements specified under paragraph "Dissimilar Materials" in the Appendix to AAMA 101.
- C. Set sill members and other members in a bed of compound or with joint fillers or gaskets, as shown, to provide weathertight construction. Refer to the "Joint Sealer" sections of Division 7 for compounds, fillers, and gaskets to be installed concurrently with window units. Coordinate installation with wall flashings and other components of the work.
- D. Implied in these specifications is that the manufacturer's window and door systems include all components necessary for a complete installation. This includes aluminum sub sills, interior and exterior trim, and hardware, whether indicated on drawings or not.
- E. Seal frames and windows with approved sealant in color to match frames, or as selected by Architect, making a neat fully weather tight installation. Refer to Section 07901 for sealant requirements.

### 3.3 ADJUSTING

- A. Adjust operating sash and hardware to provide a tight fit at contact points and at weatherstripping for smooth operation and a weathertight closure.

### 3.4 CLEANING

- A. Clean aluminum surfaces promptly after installation. Thoroughly clean aluminum surfaces as recommended by manufacturer. Exercise care to avoid damage to protective coatings and finishes. Remove excess glazing and sealant compounds, dirt, and other substances. Lubricate hardware and other moving parts.
- B. Clean glass of pre-glazed units promptly after installation of windows. Comply with requirements of the "Glass and Glazing" section for cleaning and maintenance.

### 3.5 PROTECTION

- A. Initiate and maintain protection and other precautions required through the remainder of the construction period, to ensure that, except for normal weathering, units will be free of damage or deterioration at the time of Substantial Completion.

**END OF SECTION 084113**

## **SECTION 087100 - DOOR HARDWARE**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Commercial door hardware for the following:
    - a. Swinging doors.
    - b. Non-fire-rated sliding doors.
    - c. Non-fire-rated folding doors.
    - d. Other doors to the extent indicated.
  - 2. Cylinders for doors specified in other Sections.
  - 3. Electrified door hardware.
- B. Related Sections include the following:
  - 1. Division 08 Section "Hollow Metal Doors and Frames" for door silencers provided as part of hollow-metal frames.
  - 2. Division 08 Section "Aluminum-Framed Entrances and Storefronts" for entrance door hardware, except cylinders.
  - 3. Division 26 Sections for connections to electrical power system and for low-voltage wiring work.
  - 4. "Access Control" Drawings for access control devices installed at door openings and provided as part of a security access system.
  - 5. Division 28 Section "Fire Detection and Alarm" for connections to building fire alarm system.

#### **1.3 SUBMITTALS**

- A. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Details of electrified door hardware, indicating the following:
  - 1. Wiring Diagrams: Power, signal, and control wiring. Include the following:

- a. System schematic.
  - b. Point-to-point wiring diagram.
  - c. Riser diagram.
  - d. Elevation of each door.
2. Detail interface between electrified door hardware and fire alarm, access control, security system.
3. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.
- C. Samples for Initial Selection: For each finish, color, and texture required for each type of door hardware indicated.
- D. Samples for Verification: Submit minimum 2-by-4-inch plate Samples of each type of finish required, except primed finish.
- E. Product Certificates: For electrified door hardware, signed by product manufacturer.
  1. Certify that door hardware approved for use on types and sizes of labeled fire doors complies with listed fire door assemblies.
- F. Qualification Data: For **Installer**.
- G. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.
- H. Warranty: Special warranty specified in this Section.
- I. Other Action Submittals:
  1. Door Hardware Sets: Prepared by or under the supervision of Architectural Hardware Supplier detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
    - a. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
    - b. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
    - c. Content: Include the following information:
      - 1) Identification number, location, hand, fire rating, and material of each door and frame.
      - 2) Type, style, function, size, quantity, and finish of each door hardware item.
      - 3) Complete designations of every item required for each door or opening including name and manufacturer.
      - 4) Fastenings and other pertinent information.

- 5) Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
  - 6) Explanation of abbreviations, symbols, and codes contained in schedule.
  - 7) Mounting locations for door hardware.
  - 8) Door and frame sizes and materials.
  - 9) Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.
    - a) Sequence of Operation: Include description of component functions that occur in the following situations: authorized person wants to enter; authorized person wants to exit; unauthorized person wants to enter; unauthorized person wants to exit.
  - 10) List of related door devices specified in other Sections for each door and frame.
- d. Submittal Sequence: Submit the final door hardware sets at earliest possible date, particularly where approval of the door hardware sets must precede fabrication of other work that is critical in Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the door hardware sets.
2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

#### 1.4 QUALITY ASSURANCE

- A. Architectural Hardware Supplier Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.
1. Electrified Door Hardware Consultant Qualifications: A qualified Architectural Hardware Consultant who is experienced in providing consulting services for electrified door hardware installations.
- B. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.
1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
- D. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." In addition to Owner Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant and Owner's security consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
  - 1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
  - 2. Preliminary key system schematic diagram.
  - 3. Requirements for key control system.
  - 4. Address for delivery of keys.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to electrified door hardware including, but not limited to, the following:
  - 1. Inspect and discuss electrical roughing-in and other preparatory work performed by other trades.
  - 2. Review sequence of operation for each type of electrified door hardware.
  - 3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 4. Review required testing, inspecting, and certifying procedures.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys, and permanent cores, if provided, to Owner or Owner’s Representative by hand delivery, registered mail or overnight package service.

1.6 COORDINATION

- A. Coordinate layout and installation of recessed pivots and closers with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to power supplies, fire alarm system and detection devices, access control system, security system, etc..
- D. Existing Openings: Where new hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide for proper operation.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including excessive deflection, cracking, or breakage.
    - b. Faulty operation of operators and door hardware.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
  - 2. Warranty Period: One (1) year from date of Substantial Completion, except as follows:
    - a. Electromagnetic Locks: Five years from date of Substantial Completion.
    - b. Exit Devices: Two years from date of Substantial Completion.
    - c. Manual Closers: 10 years from date of Substantial Completion.
    - d. Concealed Floor Closers: Five years from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

## PART 2 - PRODUCTS

### 2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in this Section and door hardware sets indicated in Part 3 "Door Hardware Sets" Article.
  - 1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
  - 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Sets" Article. Products are identified by using door hardware designations, as follows:
  - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Sets" Article.
  - 2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

### 2.2 HINGES, GENERAL

- A. Quantity: Provide the following, unless otherwise indicated:
  - 1. Two Hinges: For doors with heights up to 60 inches.
  - 2. Three Hinges: For doors with heights 61 to 90 inches.
  - 3. Four Hinges: For doors with heights 91 to 120 inches.
  - 4. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
- B. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.
- C. Hinge Weight: Unless otherwise indicated, provide the following:
  - 1. Entrance Doors: Heavy-weight hinges.
  - 2. Doors with Closers: Antifriction-bearing hinges.
  - 3. Interior Doors: Standard-weight hinges.
- D. Hinge Base Metal: Unless otherwise indicated, provide the following:
  - 1. Exterior Hinges: Stainless steel, with stainless-steel pin.
  - 2. Interior Hinges: Steel, with steel pin.
  - 3. Hinges for Fire-Rated Assemblies: Steel, with steel pin.



- E. Hinge Options: Where indicated in door hardware sets or on Drawings:
  - 1. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for outswinging exterior doors.
  - 2. Corners: Square.
- F. Fasteners: Comply with the following:
  - 1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
  - 2. Wood Screws: For wood doors and frames.
  - 3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
  - 4. Screws: Phillips flat-head; machine screws (drilled and tapped holes) for metal doors and wood screws for wood doors and frames. Finish screw heads to match surface of hinges.

## 2.3 HINGES

- A. Butts and Hinges: BHMA A156.1.
- B. Template Hinge Dimensions: BHMA A156.7.
- C. Available Manufacturers:
  - 1. Bommer Industries, Inc. (BI).
  - 2. PBB, Inc. (PBB).
  - 3. Ives Hardware; an Ingersoll-Rand Company (IVS).
  - 4. Manufacturer’s as may be listed on Hardware Schedule below.

## 2.4 PIVOTS AND PIVOT HINGES

- A. Pivots: BHMA A156.4.
- B. Self-Closing Pivot Hinges: BHMA A156.17.
- C. Available Manufacturers:
  - 1. Bommer Industries, Inc. (BI).
  - 2. IVES Hardware; an Ingersoll-Rand Company (IVS).
  - 3. Rixson Specialty Door Controls; an ASSA ABLOY Group company (RIX).
  - 4. Manufacturer’s as may be listed on Hardware Schedule below.

## 2.5 LOCKS AND LATCHES, GENERAL

- A. Accessibility Requirements: Where indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)," and ANSI A117.1

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
- B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.
- C. Electrified Locking Devices: BHMA A156.25.
- D. Lock Trim:
  1. Levers: Cast.
  2. Roses: Wrought.
  3. Dummy Trim: Match lever lock trim and escutcheons.
  4. Lockset Designs: Grade 1: Sargent 10 Line, Falcon T Series, Schlage ND Series or, if sets are provided by another manufacturer, provide designs that match those designated.
- E. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
  1. Bored Locks: Minimum 1/2-inch latchbolt throw.
  2. Mortise Locks: Minimum 3/4-inch latchbolt throw.
  3. Deadbolts: Minimum 1-inch bolt throw.
- F. Rabbeted Meeting Doors: Provide special rabbeted front and strike on locksets for rabbeted meeting stiles.
- G. Backset: 2-3/4 inches, unless otherwise indicated.
- H. Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, and as follows:
  1. Strikes for Bored Locks and Latches: BHMA A156.2.
  2. Strikes for Mortise Locks and Latches: BHMA A156.13.
  3. Strikes for Interconnected Locks and Latches: BHMA A156.12.
  4. Strikes for Auxiliary Deadlocks: BHMA A156.5.
  5. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
  6. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
  7. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.

## 2.6 DOOR BOLTS

- A. Bolt Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
  1. Half-Round Surface Bolts: Minimum 7/8-inch throw.

2. Interlocking Surface Bolts: Minimum 15/16-inch throw.
  3. Fire-Rated Surface Bolts: Minimum 1-inch throw; listed and labeled for fire-rated doors.
  4. Dutch-Door Bolts: Minimum 3/4-inch throw.
  5. Mortise Flush Bolts: Minimum 3/4-inch throw.
- B. Dustproof Strikes: BHMA A156.16, Grade 1.
- C. Surface Bolts: BHMA A156.16, Grade 1.
1. Flush Bolt Heads: Minimum of 1/2-inch- diameter rods of brass, bronze, or stainless steel with minimum 12-inch- long rod for doors up to 84 inches in height. Provide longer rods as necessary for doors exceeding 84 inches.
  2. Available Manufacturers:
    - a. Burns Manufacturing Incorporated (BM).
    - b. Don-Jo Mfg., Inc. (DJO).
    - c. Door Controls International (DCI).
    - d. Glynn-Johnson; an Ingersoll-Rand Company (GJ).
    - e. Hager Companies (HAG).
    - f. IVES Hardware; an Ingersoll-Rand Company (IVS).
    - g. Trimco (TBM).
    - h. Rockwood
    - i. Manufacturer’s as may be listed on Hardware Schedule below.
- D. Manual Flush Bolts: BHMA A156.16, Grade 1; designed for mortising into door edge.
1. Available Manufacturers:
    - a. Adams Rite Manufacturing Co. (ARM).
    - b. Burns Manufacturing Incorporated (BM).
    - c. Don-Jo Mfg., Inc. (DJO).
    - d. Door Controls International (DCI).
    - e. Glynn-Johnson; an Ingersoll-Rand Company (GJ).
    - f. Hager Companies (HAG).
    - g. Hiawatha, Inc. (HIA).
    - h. IVES Hardware; an Ingersoll-Rand Company (IVS).
    - i. Trimco (TBM).
    - j. Rockwood
    - k. Manufacturer’s as may be listed on Hardware Schedule below.
- E. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1; designed for mortising into door edge.
1. Available Manufacturers:
    - a. Rockwood.
    - b. Door Controls International (DCI).
    - c. Glynn-Johnson; an Ingersoll-Rand Company (GJ).

- d. Hager Companies (HAG).
- e. IVES Hardware; an Ingersoll-Rand Company (IVS).
- f. Trimco (TBM).
- g. Manufacturer’s as may be listed on Hardware Schedule below.

## 2.7 EXIT DEVICES

- A. Exit Devices: BHMA A156.3 Grade 1.
- B. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)," and ANSI A117.1
  - 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
- C. Exit Devices for Means of Egress Doors: Comply with NFPA 101. Exit devices shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.
- D. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
- E. Fire Exit Devices: Devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.
- F. Removable Mullions: BHMA A156.3.
- G. Fire-Exit Removable Mullions: Provide removable mullions for use with fire exit devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252. Mullions shall be used only with exit devices for which they have been tested.
- H. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
  - 1. Operation: Rigid.
- I. Outside Trim: Lever/Lever with cylinder; material and finish to match locksets, unless otherwise indicated.
  - 1. Match design for locksets and latchsets, unless otherwise indicated.
- J. Through Bolts: For exit devices and trim on metal doors, non-fire-rated wood doors and fire-rated wood doors.

- K. Electronic Exit Bars: Nonlatching electronic releasing device, activated by an adjustable capacitance sensor, with no moving parts; listed and labeled as panic exit hardware. Fabricate bar from extruded aluminum, and provide door and frame transfer device and 16 feet of cord to route wiring off the door frame.
- L. Available Manufacturers:
  - 1. DORMA Architectural Hardware; Member of The DORMA Group North America (DAH).
  - 2. Falcon Exit Devices & Door Hardware; an Ingersoll-Rand Company (FAL).
  - 3. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
  - 4. Von Duprin; an Ingersoll-Rand Company (VD).
  - 5. Manufacturer’s as may be listed on Hardware Schedule below.

## 2.8 LOCK CYLINDERS

- A. Standard Lock Cylinders: BHMA A156.5, Grade 1.
- B. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:
  - 1. Number of Pins: Six.
  - 2. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
  - 3. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
  - 4. **Cylinder to be same manufacturer as lock.**
- C. Manufacturer: Same manufacturer as for locks and latches.
- D. Available Manufacturers:
  - 1. Falcon Lock; an Ingersoll-Rand Company (FAL).
  - 2. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
  - 3. Schlage Commercial Lock Division; an Ingersoll-Rand Company (SCH).
  - 4. Manufacturer’s as may be listed on Hardware Schedule below.

## 2.9 KEYING

- A. Keying System: Complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference, and as follows:
  - 1. Master Key System: Cylinders are operated by a change key and a master key.
  - 2. Existing System: Master key or grand master key locks to Owner's existing system.
- B. Keys: Nickel silver.
  - 1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
    - a. Notation: **"DO NOT DUPLICATE."**

2. Quantity: In addition to one extra key blank for each lock, provide the following:
  - a. Cylinder Change Keys: Three.
  - b. Master Keys: Five.

#### 2.10 OPERATING TRIM

- A. Standard: BHMA A156.6 and as illustrated on Drawings.
- B. Materials: Fabricate from stainless steel, unless otherwise indicated.
- C. Available Manufacturers:
  1. Burns Manufacturing Incorporated (BM).
  2. Don-Jo Mfg., Inc. (DJO).
  3. Forms + Surfaces (FS).
  4. Hager Companies (HAG).
  5. Hiawatha, Inc. (HIA).
  6. IVES Hardware; an Ingersoll-Rand Company (IVS).
  7. Rockwood Manufacturing Company (RM).
  8. Trimco (TBM).
  9. Manufacturer’s as may be listed on Hardware Schedule below.

#### 2.11 ACCESSORIES FOR PAIRS OF DOORS

- A. Carry-Open Bars: Provide carry-open bars for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.
  1. Material: Polished brass or bronze, with strike plate.

#### 2.12 CLOSERS

- A. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)," and ANSI A117.1
  1. Comply with the following maximum opening-force requirements:
    - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
    - b. Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
    - c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
- B. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf to set door in motion and not more than 15 lbf to open door to minimum required width.

- C. Hold-Open Closers/Detectors: Coordinate and interface integral smoke detector and closer device with fire alarm system.
- D. Flush Floor Plates: Provide finish cover plates for floor closers unless thresholds are indicated. Match door hardware finish, unless otherwise indicated.
- E. Recessed Floor Plates: Provide recessed floor plates with insert of floor finish material for floor closers unless thresholds are indicated. Provide extended closer spindle to accommodate thickness of floor finish.
- F. Power-Assist Closers: As specified in Division 08 Section "Automatic Door Operators" for access doors for people with disabilities or where listed in the door hardware sets.
- G. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
- H. Surface Closers: BHMA A156.4, Grade 1. Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated.
  - 1. Available Manufacturers:
    - a. DORMA Architectural Hardware; Member of The DORMA Group North America (DAH).
    - b. LCN Closers; an Ingersoll-Rand Company (LCN).
    - c. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
    - d. Manufacturer's as may be listed on Hardware Schedule below.
- I. Concealed Closers: BHMA A156.4, Grade 1.
  - 1. Available Manufacturers:
    - a. DORMA Architectural Hardware; Member of The DORMA Group North America (DAH).
    - b. LCN Closers; an Ingersoll-Rand Company (LCN).
    - c. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
    - d. Manufacturer's as may be listed on Hardware Schedule below.
- J. Closer Holder Release Devices: BHMA A156.15.
  - 1. Life-Safety Type: On release of hold open, door becomes self-closing. Automatic release is activated by smoke detection system or loss of power.
  - 2. Available Manufacturers:
    - a. DORMA Architectural Hardware; Member of The DORMA Group North America (DAH).
    - b. LCN Closers; an Ingersoll-Rand Company (LCN).
    - c. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
    - d. Manufacturer's as may be listed on Hardware Schedule below.

- K. Coordinators: BHMA A156.3.

## 2.13 PROTECTIVE TRIM UNITS

- A. Size: 1-1/2 inches less than door width on push side and 1/2 inch less than door width on pull side, by height specified in door hardware sets.
- B. Fasteners: Manufacturer's standard machine or self-tapping screws.
- C. Metal Protective Trim Units: BHMA A156.6; beveled top and 2 sides; fabricated from material indicated in door hardware sets.
  - 1. Material: 0.050-inch- thick stainless steel.
  - 2. Available Manufacturers:
    - a. American Floor Products Co., Inc. (AFP).
    - b. Baldwin Hardware Corporation (BH).
    - c. Burns Manufacturing Incorporated (BM).
    - d. Don-Jo Mfg., Inc. (DJO).
    - e. Hager Companies (HAG).
    - f. Hiawatha, Inc. (HIA).
    - g. IPC Door and Wall Protection Systems, Inc.; Div. of InPro Corporation (IPC).
    - h. IVES Hardware; an Ingersoll-Rand Company (IVS).
    - i. Pawling Corporation (PAW).
    - j. Rockwood Manufacturing Company (RM).
    - k. Trimco (TBM).
    - l. Manufacturer's as may be listed on Hardware Schedule below.

## 2.14 STOPS AND HOLDERS

- A. Stops and Bumpers: BHMA A156.16, Grade 1.
  - 1. Provide floor stops for doors unless wall or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic. Where floor or wall stops are not appropriate, provide overhead holders.
- B. Combination Floor and Wall Stops and Holders: BHMA A156.8, Grade 1.
- C. Silencers for Metal Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum diameter 1/2 inch fabricated for drilled-in application to frame.
- D. Available Manufacturers:
  - 1. Architectural Builders Hardware Mfg., Inc. (ABH).
  - 2. Baldwin Hardware Corporation (BH).
  - 3. Burns Manufacturing Incorporated (BM).
  - 4. Cal-Royal Products, Inc. (CRP).



5. Don-Jo Mfg., Inc. (DJO).
6. Door Controls International (DCI).
7. DORMA Architectural Hardware; Member of The DORMA Group North America (DAH).
8. Dor-O-Matic; an Ingersoll-Rand Company (DOR).
9. Glynn-Johnson; an Ingersoll-Rand Company (GJ).
10. Hager Companies (HAG).
11. HES, Inc.; an ASSA ABLOY Group company (HES).
12. Hiawatha, Inc. (HIA).
13. IVES Hardware; an Ingersoll-Rand Company (IVS).
14. Rixson Specialty Door Controls; an ASSA ABLOY Group company (RIX).
15. Rockwood Manufacturing Company (RM).
16. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
17. Stanley Commercial Hardware; Div. of The Stanley Works (STH).
18. Trimco (TBM).
19. Manufacturer’s as may be listed on Hardware Schedule below.

## 2.15 DOOR GASKETING

- A. Standard: BHMA A156.22
- B. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.
  1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
  2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
  3. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.
- C. Air Leakage: Not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.
- D. Smoke-Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke-control ratings indicated, based on testing according to UL 1784.
  1. Provide smoke-labeled gasketing on 20-minute-rated doors and on smoke-labeled doors.
- E. Fire-Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252
- F. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.
- G. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

- H. Gasketing Materials: ASTM D 2000 and AAMA 701/702.
- I. Available Manufacturers:
  - 1. Hager Companies (HAG).
  - 2. M-D Building Products, Inc. (MD).
  - 3. National Guard Products (NGP).
  - 4. Pemko Manufacturing Co. (PEM).
  - 5. Reese Enterprises (RE).
  - 6. Sealeze; a unit of Jason Incorporated (SEL).
  - 7. Zero International (ZRO).
  - 8. Manufacturer’s as may be listed on Hardware Schedule below.

## 2.16 THRESHOLDS

- A. Standard: BHMA A156.21
- B. Accessibility Requirements: Where thresholds are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)," and ANSI A117.1.
  - 1. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
- C. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2 inch high.
- D. Available Manufacturers:
  - 1. Hager Companies (HAG).
  - 2. M-D Building Products, Inc. (MD).
  - 3. National Guard Products (NGP).
  - 4. Pemko Manufacturing Co. (PEM).
  - 5. Reese Enterprises (RE).
  - 6. Rixson Specialty Door Controls; an ASSA ABLOY Group company (RIX).
  - 7. Sealeze; a unit of Jason Incorporated (SEL).
  - 8. Zero International (ZRO).
  - 9. Manufacturer’s as may be listed on Hardware Schedule below.

## 2.17 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.
  - 1. Manufacturer's identification is permitted on rim of lock cylinders only.

- B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.
- C. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
  - 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
  - 2. Steel Machine or Wood Screws: For the following fire-rated applications:
    - a. Mortise hinges to doors.
    - b. Strike plates to frames.
    - c. Closers to doors and frames.
  - 3. Steel Through Bolts: For the following fire-rated applications unless door blocking is provided:
    - a. Surface hinges to doors.
    - b. Closers to doors and frames.
    - c. Surface-mounted exit devices.
  - 4. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
  - 5. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."

## 2.18 FINISHES

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

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

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

#### 3.2 PREPARATION

- A. Steel Doors and Frames: Comply with DHI A115 Series.
  - 1. Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI A250.6.
- B. Wood Doors: Comply with DHI A115-W Series.

#### 3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights indicated as follows unless otherwise indicated or required to comply with governing regulations.
  - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
  - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
  - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
  - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

### 3.4 FIELD QUALITY CONTROL

- A. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
  - 1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

### 3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
  - 1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
  - 2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
  - 3. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.
- B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust, including adjusting operating forces, each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

### 3.6 CLEANING AND PROTECTION

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

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.8 DOOR HARDWARE SCHEDULE

***Refer to Hardware Schedule listed as an attachment to this specification below.***

***Contractor is required to clarify any/all door hardware required for any missing doors that may not be listed/scheduled above but shown on Drawings prior to bidding.***

***Contractor is required to review all door hardware with Owner's representative and obtain approval prior to ordering or installing.***

***See Section 084113 for aluminum door hardware. Wood Door/Hardware Supplier shall coordinate with Aluminum Door/Frame supplier for required hardware coordination.***

**END OF SECTION 087100**

# Hardware Schedule

The Arc of the Ozarks  
Project 9762 Contract

## Hardware Set 01

Office Doors

### Hardware Per Opening

<u>Door#</u>	<u>Keyed</u>	<u>area</u>	<u>x Egress area</u>	<u>Type</u>	<u>Size</u>	<u>Thk</u>	<u>Hand</u>	<u>Label</u>	<u>Door/Frame</u>	<u>Elev</u>
111	DAY PROGRAM	T	OFFICE	SGL	30 70	1 3/4	LH	N/A	WD x EXIST	E2
112	DAY PROGRAM	T	OFFICE	SGL	30 70	1 3/4	LH	N/A	WD x EXIST	E2
113	DAY PROGRAM	T	OFFICE	SGL	30 70	1 3/4	LH	N/A	WD x EXIST	E2
116	PROGRAMS	T	OFFICE 116	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	E2
117	PROGRAMS	T	OFFICE 117	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	E2
118	PROGRAMS	T	OFFICE 118	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	E2
119	PROGRAMS	T	OFFICE 119	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	E2
120	PROGRAMS	T	OFFICE 120	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	E2
121	COR 131	T	DIRECTOR	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	E2
122	PROGRAMS	T	CONF RM 122	SGL	30 70	1 3/4	LH	N/A	WD x EXIST	E2
123	PROGRAMS	T	CONF RM 123	SGL	30 70	1 3/4	LH	N/A	WD x HMF	E
124	COR 109	T	OFFICE 124	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	E2
125	COR 131	T	CLINIC OFFICE	SGL	30 70	1 3/4	LH	N/A	WD x EXIST	E2
129	COR 109	T	CONF RM 129	SGL	30 70	1 3/4	LH	N/A	WD x HMF	E
139	COR 131	T	OFFICE 139	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	E2
140	COR 131	T	OFFICE 140	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	E2
141	COR 131	T	OFFICE 141	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	E2
142	COR 131	T	OFFICE 142	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	E2
143	COR 131	T	OFFICE 143	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	E2

<u>Manufacturer</u>		<u>Qty</u>	<u>Description</u>
IVES	Hinge - (4-1/2 Std Wt(.134))	3 Ea	5BB1 X 4.5 X 4.5 X 626
SCHLAG	Cyl. Lockset (with thru-bolts)	1 Ea	ND50GD x RHO x 13-247 X 10-025 X MK X 626
ROCKWO	Wall Stop	1 Ea	WALL STOP 409 X 630
NGPFull	Weatherstrip	1 Ea	5050B X 17 X B
NGPFull	Door Bottom	1 Ea	222N x 36"

# Hardware Schedule

The Arc of the Ozarks  
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# Hardware Schedule

The Arc of the Ozarks  
Project 9762 Contract

## Hardware Set 02

Single Storage Doors

### Hardware Per Opening

<u>Door#</u>	<u>Keyed area</u>	<u>x Egress area</u>	<u>Type</u>	<u>Size</u>	<u>Thk</u>	<u>Hand</u>	<u>Label</u>	<u>Door/Frame</u>	<u>Elev</u>
101A	LOBBY	F STORAGE	SGL	30 70	1 3/4	LHR	N/A	WD x HMF	C
104B	ADMIN	T STORAGE	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	C2
105	COR 106	T M/E	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	C2
107A	COR 109	T STORAGE	SGL	30 70	1 3/4	RH	N/A	WD x HMF	C
114B	DAY PROGRAM	T STORAGE	SGL	30 70	1 3/4	LH	N/A	WD x HMF	C
130	COR 131	T JAN. CLOSET	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	C2
136A	KITCHEN	T PANTRY	SGL	30 70	1 3/4	LH	N/A	WD x HMF	C

<u>Manufacturer</u>		<u>Qty</u>	<u>Description</u>
IVES	Hinge - (4-1/2 Std Wt(.134))	3 Ea	5BB1 X 4.5 X 4.5 X 626
SCHLAG	Cyl. Lockset (with thru-bolts)	1 Ea	ND80GD x RHO x 13-247 X 10-025 X MK X 626
ROCKWO	Wall Stop	1 Ea	WALL STOP 409 X 630
IVES	Silencer	3 Ea	SR64 X GRY

# Hardware Schedule

The Arc of the Ozarks  
Project 9762 Contract

## Hardware Set 03

Double Storage Doors

### Hardware Per Opening

<u>Door#</u>	<u>Keyed area</u>	<u>x Egress area</u>	<u>Type</u>	<u>Size</u>	<u>Thk</u>	<u>Hand</u>	<u>Label</u>	<u>Door/Frame</u>	<u>Elev</u>
108A	ACTIVITY	F STORAGE	DBL	60 70	1 3/4	RHRA	N/A	WD x HMF	F
114A	DAY PROGRAM	F STORAGE	DBL	60 70	1 3/4	RHRA	N/A	WD x HMF	F
135A	TRAINING RM	F STORAGE	SGL	60 70	1 3/4	RHRA	N/A	WD x HMF	F

<u>Manufacturer</u>		<u>Qty</u>	<u>Description</u>
IVES	Hinge - (4-1/2 Std Wt(.134))	6 Ea	5BB1 X 4.5 X 4.5 X 626
ROCKWO	Flush Bolt - Manual (Extension)	2 Ea	FLUSH BOLT 555 X 626
SCHLAG	Cyl. Lockset (with thru-bolts)	1 Ea	ND80GD x RHO x 13-247 X 10-025 X MK X 626
ROCKWO	Wall Stop	2 Ea	WALL STOP 409 X 630
IVES	Silencer	6 Ea	SR64 X GRY

# Hardware Schedule

The Arc of the Ozarks  
Project 9762 Contract

## Hardware Set 04

Conference Rooms

### Hardware Per Opening

<u>Door#</u>	<u>Keyed</u>	<u>area</u>	<u>x Egress area</u>	<u>Type</u>	<u>Size</u>	<u>Thk</u>	<u>Hand</u>	<u>Label</u>	<u>Door/Frame</u>	<u>Elev</u>
132	COR 106	T	CONF RM 132	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	D2
135	COR 106	T	TRAINING RM	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	D2
135B	COR 106	T	TRAINING RM	SGL	30 70	1 3/4	LH	N/A	WD x EXIST	D2

<u>Manufacturer</u>		<u>Qty</u>	<u>Description</u>
IVES	Hinge - (4-1/2 Std Wt(.134))	3 Ea	5BB1 X 4.5 X 4.5 X 626
SCHLAG	Passage Set (with thru-bolts)	1 Ea	ND10S x RHO x 13-048 X 10-025 X 626
ROCKWO	Wall Stop	1 Ea	WALL STOP 409 X 630
IVES	Silencer	3 Ea	SR64 X GRY

# Hardware Schedule

The Arc of the Ozarks  
Project 9762 Contract

## Hardware Set 05

Exterior Aluminum Doors

### Hardware Per Opening

<u>Door#</u>	<u>Keyed</u>	<u>area</u>	<u>x Egress area</u>	<u>Type</u>	<u>Size</u>	<u>Thk</u>	<u>Hand</u>	<u>Label</u>	<u>Door/Frame</u>	<u>Elev</u>
114C	EXTERIOR	F	DAY PROGRAM	SGL	30 70	1 3/4	LHR	N/A	ALUM x ALUM	A

Manufacturer	Qty	Description
Misc	1 Ea	All hardware, operator and actuators by aluminum door supplier
Card Reader	1 Ea	Card reader by Others

# Hardware Schedule

The Arc of the Ozarks  
Project 9762 Contract

## Hardware Set 06

Exterior Hollow Metal Doors

### Hardware Per Opening

<u>Door#</u>	<u>Keyed</u>	<u>area</u>	<u>x Egress area</u>	<u>Type</u>	<u>Size</u>	<u>Thk</u>	<u>Hand</u>	<u>Label</u>	<u>Door/Frame</u>	<u>Elev</u>
137A	EXTERIOR	F	MAINTENANCE	SGL	30 70	1 3/4	LHR	N/A	WD x EXIST	EXI

Manufacturer		Qty	Description
IVES	Hinge - (4-1/2 Std Wt(.134))	3 Ea	5BB1 x 4.5 X 4.5 x NRP x 630
SCHLAG	Cylinder - Rim	1 Ea	80-329 X 626
VON DUP	Exit Device - Rim	1 Ea	98L X 996L-NL(#06) X 299 X 3-0 X US26D
	Closer	1 Ea	4040XP X CUSH X SRT X AL
ROCKWO	Kick Plate	1 Ea	K1050 X 10" X 34" X US32D
NGPFull	Weatherstrip	1 Ea	5050B X 17 X B
NGPFull	Sweep	1 Ea	200NA x 36
NGPFull	Threshold	1 Ea	425 X 36" X MILL
NGPFull	Drip Cap	1 Ea	DRIP CAP 16A X 40"
ROCKWO	Latch Guard	1 Ea	LATCH PROTECTOR 320 X 630

# Hardware Schedule

The Arc of the Ozarks  
Project 9762 Contract

## Hardware Set 06A

Exterior Hollow Metal Doors

### Hardware Per Opening

<u>Door#</u>	<u>Keyed</u>	<u>area</u>	<u>x Egress area</u>	<u>Type</u>	<u>Size</u>	<u>Thk</u>	<u>Hand</u>	<u>Label</u>	<u>Door/Frame</u>	<u>Elev</u>
144	EXTERIOR	F	COR 144	SGL	30 70	1 3/4	LHR	N/A	HMD x EXIST	H

Manufacturer		Qty	Description
IVES	Hinge - (4-1/2 Std Wt(.134))	3 Ea	5BB1 x 4.5 X 4.5 x NRP x 630
SCHLAG	Cylinder - Rim	1 Ea	80-329 X 626
VON DUP	Exit Device - Rim	1 Ea	98L X 996L-NL(#06) X 299 X 3-0 X US26D
VON DUP	Electric Strike	1 Ea	6113 x 12VDC x FAIL SECURE x US32D
	Closer	1 Ea	4040XP X CUSH X SRT X AL
ROCKWO	Kick Plate	1 Ea	K1050 X 10" X 34" X US32D
NGPFull	Weatherstrip	1 Ea	5050B X 17 X B
NGPFull	Sweep	1 Ea	200NA x 36
NGPFull	Threshold	1 Ea	425 X 36" X MILL
NGPFull	Drip Cap	1 Ea	DRIP CAP 16A X 40"
ROCKWO	Latch Guard	1 Ea	LATCH PROTECTOR 320 X 630
	Card Reader	1 Ea	Card reader by Others

# Hardware Schedule

The Arc of the Ozarks  
Project 9762 Contract

## Hardware Set 07

Water Entry Room Door

### Hardware Per Opening

<u>Door#</u>	<u>Keyed</u>	<u>area</u>	<u>x Egress area</u>	<u>Type</u>	<u>Size</u>	<u>Thk</u>	<u>Hand</u>	<u>Label</u>	<u>Door/Frame</u>	<u>Elev</u>
145	EXTERIOR	F	SPRINKLER	SGL	30 70	1 3/4	RHR	N/A	HMD x EXIST	G

Manufacturer		Qty	Description
IVES	Hinge - (4-1/2 Std Wt(.134))	3 Ea	5BB1 x 4.5 X 4.5 x NRP x 630
SCHLAG	Cyl. Lockset (with thru-bolts)	1 Ea	ND80GD x RHO x 13-247 X 10-025 X MK X 626
	Closer	1 Ea	4040XP X CUSH X SRT X AL
NGPFull	Weatherstrip	1 Ea	5050B X 17 X B
NGPFull	Sweep	1 Ea	200NA x 36
NGPFull	Threshold	1 Ea	803N x 36"
NGPFull	Drip Cap	1 Ea	DRIP CAP 16A X 40"
ROCKWO	Latch Guard	1 Ea	LATCH PROTECTOR 320 X 630

# Hardware Schedule

The Arc of the Ozarks  
Project 9762 Contract

## Hardware Set 08

Individual Restrooms

### Hardware Per Opening

<u>Door#</u>	<u>Keyed</u>	<u>area</u>	<u>x Egress area</u>	<u>Type</u>	<u>Size</u>	<u>Thk</u>	<u>Hand</u>	<u>Label</u>	<u>Door/Frame</u>	<u>Elev</u>
101B	LOBBY	T	RESTROOM	SGL	30 70	1 3/4	LH	N/A	WD x EXIST	C2
127	COR 126	T	RESTROOM	SGL	30 70	1 3/4	LH	N/A	WD x HMF	C
128	COR 126	T	RESTROOM	SGL	30 70	1 3/4	RH	N/A	WD x HMF	C

<u>Manufacturer</u>		<u>Qty</u>	<u>Description</u>
IVES	Hinge - (4-1/2 Std Wt(.134))	3 Ea	5BB1 X 4.5 X 4.5 X 626
SCHLAG	Privacy Set (with thru-bolts)	1 Ea	ND40S X RHO X 13-048 X 10-025 X 626
SCHLAG	Deadlock - Cylindrical	1 Ea	B571 X626
ROCKWO	Wall Stop	1 Ea	WALL STOP 409 X 630
IVES	Silencer	3 Ea	SR64 X GRY



# Hardware Schedule

The Arc of the Ozarks  
Project 9762 Contract

## Hardware Set 09

Group Restrooms

### Hardware Per Opening

<u>Door#</u>	<u>Keyed</u>	<u>area</u>	<u>x Egress area</u>	<u>Type</u>	<u>Size</u>	<u>Thk</u>	<u>Hand</u>	<u>Label</u>	<u>Door/Frame</u>	<u>Elev</u>
133	COR 106	T	WOMEN'S RR	SGL	30 70	1 3/4	LH	N/A	WD x EXIST	C2
134	COR 106	T	MEN'S RR	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	C2

Manufacturer		Qty	Description
IVES	Hinge - (4-1/2 Std Wt(.134))	3 Ea	5BB1 X 4.5 X 4.5 X 626
ROCKWO	Push Plate	1 Ea	70C X US32D
ROCKWO	Pull Plate	1 Ea	107 X 70C X TYPE 1 X US32D
LCN	Closer	1 Ea	4040XP.RWPA.689 x 689
ROCKWO	Kick Plate	1 Ea	K1050 X 10" X 34" X US32D
ROCKWO	Wall Stop	1 Ea	WALL STOP 406 X 630
IVES	Silencer	3 Ea	SR64 X GRY

# Hardware Schedule

The Arc of the Ozarks  
Project 9762 Contract

## Hardware Set 10

Access Control Hall Doors

### Hardware Per Opening

<u>Door#</u>	<u>Keyed area</u>	<u>x Egress area</u>	<u>Type</u>	<u>Size</u>	<u>Thk</u>	<u>Hand</u>	<u>Label</u>	<u>Door/Frame</u>	<u>Elev</u>
101	ENTRY	F LOBBY	SGL/S	30 70	1 3/4	RHR	N/A	WD x EXIST	D2
102	LOBBY	F RECEPTION	SGL	30 70	1 3/4	LHR	N/A	WD x HMF	D
106	LOBBY	F COR 106	SGL	30 70	1 3/4	RHR	N/A	WD x HMF	D
109	COR 106	F COR 109	SGL	30 70	1 3/4	RHR	N/A	WD x EXIST	D2
115	COR 109	F PROGRAMS	SGL	30 70	1 3/4	LHR	N/A	WD x HMF	E
131	COR 106	F COR 131	SGL	30 70	1 3/4	RHR	N/A	WD x EXIST	D2

<u>Manufacturer</u>		<u>Qty</u>	<u>Description</u>
IVES	Hinge - (4-1/2 Std Wt(.134))	3 Ea	5BB1 X 4.5 X 4.5 X 626
SCHLAG	Cylinder - Rim	1 Ea	80-329 X 626
VON DUP	Exit Device - Rim	1 Ea	98L X 996L-NL(#06) X 299 X 3-0 X US26D
VON DUP	Electric Strike	1 Ea	6113 X 12VDC X FAIL SAFE X US32D
LCN	Closer	1 Ea	4040XP X HCUSH X SRT X AL
ROCKWO	Kick Plate	1 Ea	K1050 X 10" X 34" X US32D
ROCKWO	Wall Stop	1 Ea	WALL STOP 409 X 630
IVES	Silencer	3 Ea	SR64 X GRY

# Hardware Schedule

The Arc of the Ozarks  
Project 9762 Contract

## Hardware Set 11

Doors Off hallways

### Hardware Per Opening

<u>Door#</u>	<u>Keyed</u>	<u>area</u>	<u>x Egress area</u>	<u>Type</u>	<u>Size</u>	<u>Thk</u>	<u>Hand</u>	<u>Label</u>	<u>Door/Frame</u>	<u>Elev</u>
104	COR 106	T	ADMIN	SGL	30 70	1 3/4	LH	N/A	WD x EXIST	E2
104A	RECEPTION	F	ADMIN	SGL	30 70	1 3/4	LHR	N/A	WD x HMF	E
115A	PROGRAMS	T	WORK ROOM	SGL	30 70	1 3/4	RH	N/A	WD x HMF	C

<u>Manufacturer</u>		<u>Qty</u>	<u>Description</u>
IVES	Hinge - (4-1/2 Std Wt(.134))	3 Ea	5BB1 X 4.5 X 4.5 X 626
SCHLAG	Cyl. Lockset (with thru-bolts)	1 Ea	ND70GD x RHO x 13-247 X 10-025 X MK X 626
LCN	Closer	1 Ea	4040XP.RWPA.689 x 689
ROCKWO	Kick Plate	1 Ea	K1050 X 10" X 34" X US32D
ROCKWO	Wall Stop	1 Ea	WALL STOP 409 X 630
IVES	Silencer	3 Ea	SR64 X GRY

# Hardware Schedule

The Arc of the Ozarks  
Project 9762 Contract

## Hardware Set 11A

No Closer

### Hardware Per Opening

<u>Door#</u>	<u>Keyed area</u>	<u>x Egress area</u>	<u>Type</u>	<u>Size</u>	<u>Thk</u>	<u>Hand</u>	<u>Label</u>	<u>Door/Frame</u>	<u>Elev</u>
107	COR 106	T FUTURE	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	E2
108	COR 109	T ACTIVITY	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	E2
110	DAY PROGRAM	T SENSORY	SGL	30 70	1 3/4	RH	N/A	WD x HMF	E
110A	ACTIVITY	T SENSORY	SGL	30 70	1 3/4	LH	N/A	WD x HMF	E
114	COR 109	F DAY PROGRAM	SGL	30 70	1 3/4	RHR	N/A	WD x HMF	E
138	COR 106	T BREAK ROOM	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	D2

<u>Manufacturer</u>		<u>Qty</u>	<u>Description</u>
IVES	Hinge - (4-1/2 Std Wt(.134))	3 Ea	5BB1 X 4.5 X 4.5 X 626
SCHLAG	Cyl. Lockset (with thru-bolts)	1 Ea	ND70GD x RHO x 13-247 X 10-025 X MK X 626
ROCKWO	Kick Plate	1 Ea	K1050 X 10" X 34" X US32D
ROCKWO	Wall Stop	1 Ea	WALL STOP 409 X 630
IVES	Silencer	3 Ea	SR64 X GRY

Hardware Schedule

The Arc of the Ozarks  
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Hardware Set 11B

Hardware Per Opening

<u>Door#</u>	<u>Keyed area</u>	<u>x Egress area</u>	<u>Type</u>	<u>Size</u>	<u>Thk</u>	<u>Hand</u>	<u>Label</u>	<u>Door/Frame</u>	<u>Elev</u>	
136	COR 106	T	TRAINING KITCH	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	J

Manufacturer		Qty	Description
IVES	Hinge - (4-1/2 Std Wt(.134))	3 Ea	5BB1 X 4.5 X 4.5 X 626
SCHLAG	Cyl. Lockset (with thru-bolts)	1 Ea	ND70GD x RHO x 13-247 X 10-025 X MK X 626
ROCKWO	Armor Plate	1 Ea	K1050 X 36"H X 34"W X US32D
ROCKWO	Wall Stop	1 Ea	WALL STOP 409 X 630
IVES	Silencer	3 Ea	SR64 X GRY

# Hardware Schedule

The Arc of the Ozarks  
Project 9762 Contract

## Hardware Set 13

### Hardware Per Opening

<u>Door#</u>	<u>Keyed area</u>	<u>x Egress area</u>	<u>Type</u>	<u>Size</u>	<u>Thk</u>	<u>Hand</u>	<u>Label</u>	<u>Door/Frame</u>	<u>Elev</u>	
137	COR 106	T	MAINTENANCE	SGL	30 70	1 3/4	LH	N/A	WD x EXIST	G

Manufacturer		Qty	Description
IVES	Hinge - (4-1/2 Std Wt(.134))	3 Ea	5BB1 X 4.5 X 4.5 X 626
SCHLAG	Cyl. Lockset (with thru-bolts)	1 Ea	ND80GD x RHO x 13-247 X 10-025 X MK X 626
LCN	Closer	1 Ea	4040XP.RWPA.689 x 689
ROCKWO	Kick Plate	1 Ea	K1050 X 10" X 34" X US32D
ROCKWO	Floor Stop	1 Ea	440 X 626
NGPFull	Weatherstrip	1 Ea	5050B X 17 X B
NGPFull	Sweep	1 Ea	C607A x 36"

# Hardware Schedule

The Arc of the Ozarks  
Project 9762 Contract

Hardware Set N/A

Hardware Per Opening

<u>Door#</u>	<u>Keyed area</u>	<u>x Egress area</u>	<u>Type</u>	<u>Size</u>	<u>Thk</u>	<u>Hand</u>	<u>Label</u>	<u>Door/Frame</u>	<u>Elev</u>
136B	KITCHEN	@ TRAINING RM	SHUT	50 40	1 3/4	SLID	N/A	ALUM x ALUM B	

## **SECTION 087100 - DOOR HARDWARE**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Commercial door hardware for the following:
    - a. Swinging doors.
    - b. Non-fire-rated sliding doors.
    - c. Non-fire-rated folding doors.
    - d. Other doors to the extent indicated.
  - 2. Cylinders for doors specified in other Sections.
  - 3. Electrified door hardware.
- B. Related Sections include the following:
  - 1. Division 08 Section "Hollow Metal Doors and Frames" for door silencers provided as part of hollow-metal frames.
  - 2. Division 08 Section "Aluminum-Framed Entrances and Storefronts" for entrance door hardware, except cylinders.
  - 3. Division 26 Sections for connections to electrical power system and for low-voltage wiring work.
  - 4. "Access Control" Drawings for access control devices installed at door openings and provided as part of a security access system.
  - 5. Division 28 Section "Fire Detection and Alarm" for connections to building fire alarm system.

#### **1.3 SUBMITTALS**

- A. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Shop Drawings: Details of electrified door hardware, indicating the following:
  - 1. Wiring Diagrams: Power, signal, and control wiring. Include the following:



- a. System schematic.
  - b. Point-to-point wiring diagram.
  - c. Riser diagram.
  - d. Elevation of each door.
2. Detail interface between electrified door hardware and fire alarm, access control, security system.
3. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.
- C. Samples for Initial Selection: For each finish, color, and texture required for each type of door hardware indicated.
- D. Samples for Verification: Submit minimum 2-by-4-inch plate Samples of each type of finish required, except primed finish.
- E. Product Certificates: For electrified door hardware, signed by product manufacturer.
  1. Certify that door hardware approved for use on types and sizes of labeled fire doors complies with listed fire door assemblies.
- F. Qualification Data: For **Installer**.
- G. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.
- H. Warranty: Special warranty specified in this Section.
- I. Other Action Submittals:
  1. Door Hardware Sets: Prepared by or under the supervision of Architectural Hardware Supplier detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
    - a. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
    - b. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.
    - c. Content: Include the following information:
      - 1) Identification number, location, hand, fire rating, and material of each door and frame.
      - 2) Type, style, function, size, quantity, and finish of each door hardware item.
      - 3) Complete designations of every item required for each door or opening including name and manufacturer.
      - 4) Fastenings and other pertinent information.

- 5) Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
  - 6) Explanation of abbreviations, symbols, and codes contained in schedule.
  - 7) Mounting locations for door hardware.
  - 8) Door and frame sizes and materials.
  - 9) Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.
    - a) Sequence of Operation: Include description of component functions that occur in the following situations: authorized person wants to enter; authorized person wants to exit; unauthorized person wants to enter; unauthorized person wants to exit.
  - 10) List of related door devices specified in other Sections for each door and frame.
- d. Submittal Sequence: Submit the final door hardware sets at earliest possible date, particularly where approval of the door hardware sets must precede fabrication of other work that is critical in Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the door hardware sets.
2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

#### 1.4 QUALITY ASSURANCE

- A. Architectural Hardware Supplier Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.
1. Electrified Door Hardware Consultant Qualifications: A qualified Architectural Hardware Consultant who is experienced in providing consulting services for electrified door hardware installations.
- B. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.
1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.

- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
- D. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Keying Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." In addition to Owner Contractor, and Architect, conference participants shall also include Installer's Architectural Hardware Consultant and Owner's security consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
  - 1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
  - 2. Preliminary key system schematic diagram.
  - 3. Requirements for key control system.
  - 4. Address for delivery of keys.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to electrified door hardware including, but not limited to, the following:
  - 1. Inspect and discuss electrical roughing-in and other preparatory work performed by other trades.
  - 2. Review sequence of operation for each type of electrified door hardware.
  - 3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  - 4. Review required testing, inspecting, and certifying procedures.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys, and permanent cores, if provided, to Owner or Owner’s Representative by hand delivery, registered mail or overnight package service.

1.6 COORDINATION

- A. Coordinate layout and installation of recessed pivots and closers with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to power supplies, fire alarm system and detection devices, access control system, security system, etc..
- D. Existing Openings: Where new hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide for proper operation.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including excessive deflection, cracking, or breakage.
    - b. Faulty operation of operators and door hardware.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
  - 2. Warranty Period: One (1) year from date of Substantial Completion, except as follows:
    - a. Electromagnetic Locks: Five years from date of Substantial Completion.
    - b. Exit Devices: Two years from date of Substantial Completion.
    - c. Manual Closers: 10 years from date of Substantial Completion.
    - d. Concealed Floor Closers: Five years from date of Substantial Completion.

1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

## PART 2 - PRODUCTS

### 2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in this Section and door hardware sets indicated in Part 3 "Door Hardware Sets" Article.
  - 1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
  - 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Sets" Article. Products are identified by using door hardware designations, as follows:
  - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Sets" Article.
  - 2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

### 2.2 HINGES, GENERAL

- A. Quantity: Provide the following, unless otherwise indicated:
  - 1. Two Hinges: For doors with heights up to 60 inches.
  - 2. Three Hinges: For doors with heights 61 to 90 inches.
  - 3. Four Hinges: For doors with heights 91 to 120 inches.
  - 4. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
- B. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.
- C. Hinge Weight: Unless otherwise indicated, provide the following:
  - 1. Entrance Doors: Heavy-weight hinges.
  - 2. Doors with Closers: Antifriction-bearing hinges.
  - 3. Interior Doors: Standard-weight hinges.
- D. Hinge Base Metal: Unless otherwise indicated, provide the following:
  - 1. Exterior Hinges: Stainless steel, with stainless-steel pin.
  - 2. Interior Hinges: Steel, with steel pin.
  - 3. Hinges for Fire-Rated Assemblies: Steel, with steel pin.

- E. Hinge Options: Where indicated in door hardware sets or on Drawings:
  - 1. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for outswinging exterior doors.
  - 2. Corners: Square.
- F. Fasteners: Comply with the following:
  - 1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
  - 2. Wood Screws: For wood doors and frames.
  - 3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.
  - 4. Screws: Phillips flat-head; machine screws (drilled and tapped holes) for metal doors and wood screws for wood doors and frames. Finish screw heads to match surface of hinges.

## 2.3 HINGES

- A. Butts and Hinges: BHMA A156.1.
- B. Template Hinge Dimensions: BHMA A156.7.
- C. Available Manufacturers:
  - 1. Bommer Industries, Inc. (BI).
  - 2. PBB, Inc. (PBB).
  - 3. Ives Hardware; an Ingersoll-Rand Company (IVS).
  - 4. Manufacturer’s as may be listed on Hardware Schedule below.

## 2.4 PIVOTS AND PIVOT HINGES

- A. Pivots: BHMA A156.4.
- B. Self-Closing Pivot Hinges: BHMA A156.17.
- C. Available Manufacturers:
  - 1. Bommer Industries, Inc. (BI).
  - 2. IVES Hardware; an Ingersoll-Rand Company (IVS).
  - 3. Rixson Specialty Door Controls; an ASSA ABLOY Group company (RIX).
  - 4. Manufacturer’s as may be listed on Hardware Schedule below.

## 2.5 LOCKS AND LATCHES, GENERAL

- A. Accessibility Requirements: Where indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)," and ANSI A117.1

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
- B. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.
- C. Electrified Locking Devices: BHMA A156.25.
- D. Lock Trim:
  1. Levers: Cast.
  2. Roses: Wrought.
  3. Dummy Trim: Match lever lock trim and escutcheons.
  4. Lockset Designs: Grade 1: Sargent 10 Line, Falcon T Series, Schlage ND Series or, if sets are provided by another manufacturer, provide designs that match those designated.
- E. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
  1. Bored Locks: Minimum 1/2-inch latchbolt throw.
  2. Mortise Locks: Minimum 3/4-inch latchbolt throw.
  3. Deadbolts: Minimum 1-inch bolt throw.
- F. Rabbeted Meeting Doors: Provide special rabbeted front and strike on locksets for rabbeted meeting stiles.
- G. Backset: 2-3/4 inches, unless otherwise indicated.
- H. Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, and as follows:
  1. Strikes for Bored Locks and Latches: BHMA A156.2.
  2. Strikes for Mortise Locks and Latches: BHMA A156.13.
  3. Strikes for Interconnected Locks and Latches: BHMA A156.12.
  4. Strikes for Auxiliary Deadlocks: BHMA A156.5.
  5. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
  6. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
  7. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.

## 2.6 DOOR BOLTS

- A. Bolt Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
  1. Half-Round Surface Bolts: Minimum 7/8-inch throw.

2. Interlocking Surface Bolts: Minimum 15/16-inch throw.
  3. Fire-Rated Surface Bolts: Minimum 1-inch throw; listed and labeled for fire-rated doors.
  4. Dutch-Door Bolts: Minimum 3/4-inch throw.
  5. Mortise Flush Bolts: Minimum 3/4-inch throw.
- B. Dustproof Strikes: BHMA A156.16, Grade 1.
- C. Surface Bolts: BHMA A156.16, Grade 1.
1. Flush Bolt Heads: Minimum of 1/2-inch- diameter rods of brass, bronze, or stainless steel with minimum 12-inch- long rod for doors up to 84 inches in height. Provide longer rods as necessary for doors exceeding 84 inches.
  2. Available Manufacturers:
    - a. Burns Manufacturing Incorporated (BM).
    - b. Don-Jo Mfg., Inc. (DJO).
    - c. Door Controls International (DCI).
    - d. Glynn-Johnson; an Ingersoll-Rand Company (GJ).
    - e. Hager Companies (HAG).
    - f. IVES Hardware; an Ingersoll-Rand Company (IVS).
    - g. Trimco (TBM).
    - h. Rockwood
    - i. Manufacturer’s as may be listed on Hardware Schedule below.
- D. Manual Flush Bolts: BHMA A156.16, Grade 1; designed for mortising into door edge.
1. Available Manufacturers:
    - a. Adams Rite Manufacturing Co. (ARM).
    - b. Burns Manufacturing Incorporated (BM).
    - c. Don-Jo Mfg., Inc. (DJO).
    - d. Door Controls International (DCI).
    - e. Glynn-Johnson; an Ingersoll-Rand Company (GJ).
    - f. Hager Companies (HAG).
    - g. Hiawatha, Inc. (HIA).
    - h. IVES Hardware; an Ingersoll-Rand Company (IVS).
    - i. Trimco (TBM).
    - j. Rockwood
    - k. Manufacturer’s as may be listed on Hardware Schedule below.
- E. Automatic and Self-Latching Flush Bolts: BHMA A156.3, Grade 1; designed for mortising into door edge.
1. Available Manufacturers:
    - a. Rockwood.
    - b. Door Controls International (DCI).
    - c. Glynn-Johnson; an Ingersoll-Rand Company (GJ).



- d. Hager Companies (HAG).
- e. IVES Hardware; an Ingersoll-Rand Company (IVS).
- f. Trimco (TBM).
- g. Manufacturer’s as may be listed on Hardware Schedule below.

## 2.7 EXIT DEVICES

- A. Exit Devices: BHMA A156.3 Grade 1.
- B. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)," and ANSI A117.1
  - 1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
- C. Exit Devices for Means of Egress Doors: Comply with NFPA 101. Exit devices shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.
- D. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UL 305.
- E. Fire Exit Devices: Devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252.
- F. Removable Mullions: BHMA A156.3.
- G. Fire-Exit Removable Mullions: Provide removable mullions for use with fire exit devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252. Mullions shall be used only with exit devices for which they have been tested.
- H. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
  - 1. Operation: Rigid.
- I. Outside Trim: Lever/Lever with cylinder; material and finish to match locksets, unless otherwise indicated.
  - 1. Match design for locksets and latchsets, unless otherwise indicated.
- J. Through Bolts: For exit devices and trim on metal doors, non-fire-rated wood doors and fire-rated wood doors.

- K. Electronic Exit Bars: Nonlatching electronic releasing device, activated by an adjustable capacitance sensor, with no moving parts; listed and labeled as panic exit hardware. Fabricate bar from extruded aluminum, and provide door and frame transfer device and 16 feet of cord to route wiring off the door frame.
- L. Available Manufacturers:
  - 1. DORMA Architectural Hardware; Member of The DORMA Group North America (DAH).
  - 2. Falcon Exit Devices & Door Hardware; an Ingersoll-Rand Company (FAL).
  - 3. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
  - 4. Von Duprin; an Ingersoll-Rand Company (VD).
  - 5. Manufacturer’s as may be listed on Hardware Schedule below.

## 2.8 LOCK CYLINDERS

- A. Standard Lock Cylinders: BHMA A156.5, Grade 1.
- B. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:
  - 1. Number of Pins: Six.
  - 2. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
  - 3. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
  - 4. **Cylinder to be same manufacturer as lock.**
- C. Manufacturer: Same manufacturer as for locks and latches.
- D. Available Manufacturers:
  - 1. Falcon Lock; an Ingersoll-Rand Company (FAL).
  - 2. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
  - 3. Schlage Commercial Lock Division; an Ingersoll-Rand Company (SCH).
  - 4. Manufacturer’s as may be listed on Hardware Schedule below.

## 2.9 KEYING

- A. Keying System: Complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference, and as follows:
  - 1. Master Key System: Cylinders are operated by a change key and a master key.
  - 2. Existing System: Master key or grand master key locks to Owner's existing system.
- B. Keys: Nickel silver.
  - 1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
    - a. Notation: **"DO NOT DUPLICATE."**

2. Quantity: In addition to one extra key blank for each lock, provide the following:
  - a. Cylinder Change Keys: Three.
  - b. Master Keys: Five.

#### 2.10 OPERATING TRIM

- A. Standard: BHMA A156.6 and as illustrated on Drawings.
- B. Materials: Fabricate from stainless steel, unless otherwise indicated.
- C. Available Manufacturers:
  1. Burns Manufacturing Incorporated (BM).
  2. Don-Jo Mfg., Inc. (DJO).
  3. Forms + Surfaces (FS).
  4. Hager Companies (HAG).
  5. Hiawatha, Inc. (HIA).
  6. IVES Hardware; an Ingersoll-Rand Company (IVS).
  7. Rockwood Manufacturing Company (RM).
  8. Trimco (TBM).
  9. Manufacturer’s as may be listed on Hardware Schedule below.

#### 2.11 ACCESSORIES FOR PAIRS OF DOORS

- A. Carry-Open Bars: Provide carry-open bars for inactive leaves of pairs of doors unless automatic or self-latching bolts are used.
  1. Material: Polished brass or bronze, with strike plate.

#### 2.12 CLOSERS

- A. Accessibility Requirements: Where handles, pulls, latches, locks, and other operating devices are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)," and ANSI A117.1
  1. Comply with the following maximum opening-force requirements:
    - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
    - b. Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
    - c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
- B. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf to set door in motion and not more than 15 lbf to open door to minimum required width.

- C. Hold-Open Closers/Detectors: Coordinate and interface integral smoke detector and closer device with fire alarm system.
- D. Flush Floor Plates: Provide finish cover plates for floor closers unless thresholds are indicated. Match door hardware finish, unless otherwise indicated.
- E. Recessed Floor Plates: Provide recessed floor plates with insert of floor finish material for floor closers unless thresholds are indicated. Provide extended closer spindle to accommodate thickness of floor finish.
- F. Power-Assist Closers: As specified in Division 08 Section "Automatic Door Operators" for access doors for people with disabilities or where listed in the door hardware sets.
- G. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
- H. Surface Closers: BHMA A156.4, Grade 1. Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated.
  - 1. Available Manufacturers:
    - a. DORMA Architectural Hardware; Member of The DORMA Group North America (DAH).
    - b. LCN Closers; an Ingersoll-Rand Company (LCN).
    - c. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
    - d. Manufacturer's as may be listed on Hardware Schedule below.
- I. Concealed Closers: BHMA A156.4, Grade 1.
  - 1. Available Manufacturers:
    - a. DORMA Architectural Hardware; Member of The DORMA Group North America (DAH).
    - b. LCN Closers; an Ingersoll-Rand Company (LCN).
    - c. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
    - d. Manufacturer's as may be listed on Hardware Schedule below.
- J. Closer Holder Release Devices: BHMA A156.15.
  - 1. Life-Safety Type: On release of hold open, door becomes self-closing. Automatic release is activated by smoke detection system or loss of power.
  - 2. Available Manufacturers:
    - a. DORMA Architectural Hardware; Member of The DORMA Group North America (DAH).
    - b. LCN Closers; an Ingersoll-Rand Company (LCN).
    - c. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
    - d. Manufacturer's as may be listed on Hardware Schedule below.

- K. Coordinators: BHMA A156.3.

#### 2.13 PROTECTIVE TRIM UNITS

- A. Size: 1-1/2 inches less than door width on push side and 1/2 inch less than door width on pull side, by height specified in door hardware sets.
- B. Fasteners: Manufacturer's standard machine or self-tapping screws.
- C. Metal Protective Trim Units: BHMA A156.6; beveled top and 2 sides; fabricated from material indicated in door hardware sets.
  - 1. Material: 0.050-inch- thick stainless steel.
  - 2. Available Manufacturers:
    - a. American Floor Products Co., Inc. (AFP).
    - b. Baldwin Hardware Corporation (BH).
    - c. Burns Manufacturing Incorporated (BM).
    - d. Don-Jo Mfg., Inc. (DJO).
    - e. Hager Companies (HAG).
    - f. Hiawatha, Inc. (HIA).
    - g. IPC Door and Wall Protection Systems, Inc.; Div. of InPro Corporation (IPC).
    - h. IVES Hardware; an Ingersoll-Rand Company (IVS).
    - i. Pawling Corporation (PAW).
    - j. Rockwood Manufacturing Company (RM).
    - k. Trimco (TBM).
    - l. Manufacturer's as may be listed on Hardware Schedule below.

#### 2.14 STOPS AND HOLDERS

- A. Stops and Bumpers: BHMA A156.16, Grade 1.
  - 1. Provide floor stops for doors unless wall or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic. Where floor or wall stops are not appropriate, provide overhead holders.
- B. Combination Floor and Wall Stops and Holders: BHMA A156.8, Grade 1.
- C. Silencers for Metal Door Frames: BHMA A156.16, Grade 1; neoprene or rubber, minimum diameter 1/2 inch fabricated for drilled-in application to frame.
- D. Available Manufacturers:
  - 1. Architectural Builders Hardware Mfg., Inc. (ABH).
  - 2. Baldwin Hardware Corporation (BH).
  - 3. Burns Manufacturing Incorporated (BM).
  - 4. Cal-Royal Products, Inc. (CRP).

5. Don-Jo Mfg., Inc. (DJO).
6. Door Controls International (DCI).
7. DORMA Architectural Hardware; Member of The DORMA Group North America (DAH).
8. Dor-O-Matic; an Ingersoll-Rand Company (DOR).
9. Glynn-Johnson; an Ingersoll-Rand Company (GJ).
10. Hager Companies (HAG).
11. HES, Inc.; an ASSA ABLOY Group company (HES).
12. Hiawatha, Inc. (HIA).
13. IVES Hardware; an Ingersoll-Rand Company (IVS).
14. Rixson Specialty Door Controls; an ASSA ABLOY Group company (RIX).
15. Rockwood Manufacturing Company (RM).
16. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
17. Stanley Commercial Hardware; Div. of The Stanley Works (STH).
18. Trimco (TBM).
19. Manufacturer’s as may be listed on Hardware Schedule below.

## 2.15 DOOR GASKETING

- A. Standard: BHMA A156.22
- B. General: Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.
  1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
  2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
  3. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.
- C. Air Leakage: Not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.
- D. Smoke-Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke-control ratings indicated, based on testing according to UL 1784.
  1. Provide smoke-labeled gasketing on 20-minute-rated doors and on smoke-labeled doors.
- E. Fire-Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252
- F. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.
- G. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

- H. Gasketing Materials: ASTM D 2000 and AAMA 701/702.
- I. Available Manufacturers:
  - 1. Hager Companies (HAG).
  - 2. M-D Building Products, Inc. (MD).
  - 3. National Guard Products (NGP).
  - 4. Pemko Manufacturing Co. (PEM).
  - 5. Reese Enterprises (RE).
  - 6. Sealeze; a unit of Jason Incorporated (SEL).
  - 7. Zero International (ZRO).
  - 8. Manufacturer’s as may be listed on Hardware Schedule below.

## 2.16 THRESHOLDS

- A. Standard: BHMA A156.21
- B. Accessibility Requirements: Where thresholds are indicated to comply with accessibility requirements, comply with the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)," and ANSI A117.1.
  - 1. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
- C. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2 inch high.
- D. Available Manufacturers:
  - 1. Hager Companies (HAG).
  - 2. M-D Building Products, Inc. (MD).
  - 3. National Guard Products (NGP).
  - 4. Pemko Manufacturing Co. (PEM).
  - 5. Reese Enterprises (RE).
  - 6. Rixson Specialty Door Controls; an ASSA ABLOY Group company (RIX).
  - 7. Sealeze; a unit of Jason Incorporated (SEL).
  - 8. Zero International (ZRO).
  - 9. Manufacturer’s as may be listed on Hardware Schedule below.

## 2.17 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.
  - 1. Manufacturer's identification is permitted on rim of lock cylinders only.

- B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.
- C. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
  - 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
  - 2. Steel Machine or Wood Screws: For the following fire-rated applications:
    - a. Mortise hinges to doors.
    - b. Strike plates to frames.
    - c. Closers to doors and frames.
  - 3. Steel Through Bolts: For the following fire-rated applications unless door blocking is provided:
    - a. Surface hinges to doors.
    - b. Closers to doors and frames.
    - c. Surface-mounted exit devices.
  - 4. Spacers or Sex Bolts: For through bolting of hollow-metal doors.
  - 5. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."

## 2.18 FINISHES

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



### PART 3 - EXECUTION

#### 3.1 EXAMINATION

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

#### 3.2 PREPARATION

- A. Steel Doors and Frames: Comply with DHI A115 Series.
  - 1. Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI A250.6.
- B. Wood Doors: Comply with DHI A115-W Series.

#### 3.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights indicated as follows unless otherwise indicated or required to comply with governing regulations.
  - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
  - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 09 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
  - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
  - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.

- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."

### 3.4 FIELD QUALITY CONTROL

- A. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
  - 1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

### 3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
  - 1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
  - 2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
  - 3. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.
- B. Occupancy Adjustment: Approximately three months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust, including adjusting operating forces, each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

### 3.6 CLEANING AND PROTECTION

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

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Division 01 Section "Demonstration and Training."

3.8 DOOR HARDWARE SCHEDULE

***Refer to Hardware Schedule listed as an attachment to this specification below.***

***Contractor is required to clarify any/all door hardware required for any missing doors that may not be listed/scheduled above but shown on Drawings prior to bidding.***

***Contractor is required to review all door hardware with Owner's representative and obtain approval prior to ordering or installing.***

***See Section 084113 for aluminum door hardware. Wood Door/Hardware Supplier shall coordinate with Aluminum Door/Frame supplier for required hardware coordination.***

**END OF SECTION 087100**

# Hardware Schedule

The Arc of the Ozarks  
Project 9762 Contract

## Hardware Set 01

Office Doors

### Hardware Per Opening

<u>Door#</u>	<u>Keyed</u>	<u>area</u>	<u>x Egress area</u>	<u>Type</u>	<u>Size</u>	<u>Thk</u>	<u>Hand</u>	<u>Label</u>	<u>Door/Frame</u>	<u>Elev</u>
111	DAY PROGRAM	T	OFFICE	SGL	30 70	1 3/4	LH	N/A	WD x EXIST	E2
112	DAY PROGRAM	T	OFFICE	SGL	30 70	1 3/4	LH	N/A	WD x EXIST	E2
113	DAY PROGRAM	T	OFFICE	SGL	30 70	1 3/4	LH	N/A	WD x EXIST	E2
116	PROGRAMS	T	OFFICE 116	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	E2
117	PROGRAMS	T	OFFICE 117	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	E2
118	PROGRAMS	T	OFFICE 118	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	E2
119	PROGRAMS	T	OFFICE 119	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	E2
120	PROGRAMS	T	OFFICE 120	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	E2
121	COR 131	T	DIRECTOR	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	E2
122	PROGRAMS	T	CONF RM 122	SGL	30 70	1 3/4	LH	N/A	WD x EXIST	E2
123	PROGRAMS	T	CONF RM 123	SGL	30 70	1 3/4	LH	N/A	WD x HMF	E
124	COR 109	T	OFFICE 124	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	E2
125	COR 131	T	CLINIC OFFICE	SGL	30 70	1 3/4	LH	N/A	WD x EXIST	E2
129	COR 109	T	CONF RM 129	SGL	30 70	1 3/4	LH	N/A	WD x HMF	E
139	COR 131	T	OFFICE 139	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	E2
140	COR 131	T	OFFICE 140	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	E2
141	COR 131	T	OFFICE 141	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	E2
142	COR 131	T	OFFICE 142	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	E2
143	COR 131	T	OFFICE 143	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	E2

<u>Manufacturer</u>		<u>Qty</u>	<u>Description</u>
IVES	Hinge - (4-1/2 Std Wt(.134))	3 Ea	5BB1 X 4.5 X 4.5 X 626
SCHLAG	Cyl. Lockset (with thru-bolts)	1 Ea	ND50GD x RHO x 13-247 X 10-025 X MK X 626
ROCKWO	Wall Stop	1 Ea	WALL STOP 409 X 630
NGPFull	Weatherstrip	1 Ea	5050B X 17 X B
NGPFull	Door Bottom	1 Ea	222N x 36"

# Hardware Schedule

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# Hardware Schedule

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## Hardware Set 02

Single Storage Doors

### Hardware Per Opening

<u>Door#</u>	<u>Keyed area</u>	<u>x Egress area</u>	<u>Type</u>	<u>Size</u>	<u>Thk</u>	<u>Hand</u>	<u>Label</u>	<u>Door/Frame</u>	<u>Elev</u>
101A	LOBBY	F STORAGE	SGL	30 70	1 3/4	LHR	N/A	WD x HMF	C
104B	ADMIN	T STORAGE	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	C2
105	COR 106	T M/E	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	C2
107A	COR 109	T STORAGE	SGL	30 70	1 3/4	RH	N/A	WD x HMF	C
114B	DAY PROGRAM	T STORAGE	SGL	30 70	1 3/4	LH	N/A	WD x HMF	C
130	COR 131	T JAN. CLOSET	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	C2
136A	KITCHEN	T PANTRY	SGL	30 70	1 3/4	LH	N/A	WD x HMF	C

<u>Manufacturer</u>		<u>Qty</u>	<u>Description</u>
IVES	Hinge - (4-1/2 Std Wt(.134))	3 Ea	5BB1 X 4.5 X 4.5 X 626
SCHLAG	Cyl. Lockset (with thru-bolts)	1 Ea	ND80GD x RHO x 13-247 X 10-025 X MK X 626
ROCKWO	Wall Stop	1 Ea	WALL STOP 409 X 630
IVES	Silencer	3 Ea	SR64 X GRY

# Hardware Schedule

The Arc of the Ozarks  
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## Hardware Set 03

Double Storage Doors

### Hardware Per Opening

<u>Door#</u>	<u>Keyed area</u>	<u>x Egress area</u>	<u>Type</u>	<u>Size</u>	<u>Thk</u>	<u>Hand</u>	<u>Label</u>	<u>Door/Frame</u>	<u>Elev</u>
108A	ACTIVITY	F STORAGE	DBL	60 70	1 3/4	RHRA	N/A	WD x HMF	F
114A	DAY PROGRAM	F STORAGE	DBL	60 70	1 3/4	RHRA	N/A	WD x HMF	F
135A	TRAINING RM	F STORAGE	SGL	60 70	1 3/4	RHRA	N/A	WD x HMF	F

<u>Manufacturer</u>		<u>Qty</u>	<u>Description</u>
IVES	Hinge - (4-1/2 Std Wt(.134))	6 Ea	5BB1 X 4.5 X 4.5 X 626
ROCKWO	Flush Bolt - Manual (Extension)	2 Ea	FLUSH BOLT 555 X 626
SCHLAG	Cyl. Lockset (with thru-bolts)	1 Ea	ND80GD x RHO x 13-247 X 10-025 X MK X 626
ROCKWO	Wall Stop	2 Ea	WALL STOP 409 X 630
IVES	Silencer	6 Ea	SR64 X GRY

# Hardware Schedule

The Arc of the Ozarks  
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## Hardware Set 04

Conference Rooms

### Hardware Per Opening

<u>Door#</u>	<u>Keyed</u>	<u>area</u>	<u>x Egress area</u>	<u>Type</u>	<u>Size</u>	<u>Thk</u>	<u>Hand</u>	<u>Label</u>	<u>Door/Frame</u>	<u>Elev</u>
132	COR 106	T	CONF RM 132	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	D2
135	COR 106	T	TRAINING RM	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	D2
135B	COR 106	T	TRAINING RM	SGL	30 70	1 3/4	LH	N/A	WD x EXIST	D2

<u>Manufacturer</u>		<u>Qty</u>	<u>Description</u>
IVES	Hinge - (4-1/2 Std Wt(.134))	3 Ea	5BB1 X 4.5 X 4.5 X 626
SCHLAG	Passage Set (with thru-bolts)	1 Ea	ND10S x RHO x 13-048 X 10-025 X 626
ROCKWO	Wall Stop	1 Ea	WALL STOP 409 X 630
IVES	Silencer	3 Ea	SR64 X GRY



# Hardware Schedule

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## Hardware Set 05

Exterior Aluminum Doors

### Hardware Per Opening

<u>Door#</u>	<u>Keyed</u>	<u>area</u>	<u>x Egress area</u>	<u>Type</u>	<u>Size</u>	<u>Thk</u>	<u>Hand</u>	<u>Label</u>	<u>Door/Frame</u>	<u>Elev</u>
114C	EXTERIOR	F	DAY PROGRAM	SGL	30 70	1 3/4	LHR	N/A	ALUM x ALUM	A

Manufacturer	Qty	Description
Misc	1 Ea	All hardware, operator and actuators by aluminum door supplier
Card Reader	1 Ea	Card reader by Others

# Hardware Schedule

The Arc of the Ozarks  
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## Hardware Set 06

Exterior Hollow Metal Doors

### Hardware Per Opening

<u>Door#</u>	<u>Keyed</u>	<u>area</u>	<u>x Egress area</u>	<u>Type</u>	<u>Size</u>	<u>Thk</u>	<u>Hand</u>	<u>Label</u>	<u>Door/Frame</u>	<u>Elev</u>
137A	EXTERIOR	F	MAINTENANCE	SGL	30 70	1 3/4	LHR	N/A	WD x EXIST	EXI

Manufacturer		Qty	Description
IVES	Hinge - (4-1/2 Std Wt(.134))	3 Ea	5BB1 x 4.5 X 4.5 x NRP x 630
SCHLAG	Cylinder - Rim	1 Ea	80-329 X 626
VON DUP	Exit Device - Rim	1 Ea	98L X 996L-NL(#06) X 299 X 3-0 X US26D
	Closer	1 Ea	4040XP X CUSH X SRT X AL
ROCKWO	Kick Plate	1 Ea	K1050 X 10" X 34" X US32D
NGPFull	Weatherstrip	1 Ea	5050B X 17 X B
NGPFull	Sweep	1 Ea	200NA x 36
NGPFull	Threshold	1 Ea	425 X 36" X MILL
NGPFull	Drip Cap	1 Ea	DRIP CAP 16A X 40"
ROCKWO	Latch Guard	1 Ea	LATCH PROTECTOR 320 X 630

# Hardware Schedule

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## Hardware Set 06A

Exterior Hollow Metal Doors

### Hardware Per Opening

<u>Door#</u>	<u>Keyed</u>	<u>area</u>	<u>x Egress</u>	<u>area</u>	<u>Type</u>	<u>Size</u>	<u>Thk</u>	<u>Hand</u>	<u>Label</u>	<u>Door/Frame</u>	<u>Elev</u>
144	EXTERIOR	F	COR	144	SGL	30 70	1 3/4	LHR	N/A	HMD x EXIST	H

Manufacturer		Qty	Description
IVES	Hinge - (4-1/2 Std Wt(.134))	3 Ea	5BB1 x 4.5 X 4.5 x NRP x 630
SCHLAG	Cylinder - Rim	1 Ea	80-329 X 626
VON DUP	Exit Device - Rim	1 Ea	98L X 996L-NL(#06) X 299 X 3-0 X US26D
VON DUP	Electric Strike	1 Ea	6113 x 12VDC x FAIL SECURE x US32D
	Closer	1 Ea	4040XP X CUSH X SRT X AL
ROCKWO	Kick Plate	1 Ea	K1050 X 10" X 34" X US32D
NGPFull	Weatherstrip	1 Ea	5050B X 17 X B
NGPFull	Sweep	1 Ea	200NA x 36
NGPFull	Threshold	1 Ea	425 X 36" X MILL
NGPFull	Drip Cap	1 Ea	DRIP CAP 16A X 40"
ROCKWO	Latch Guard	1 Ea	LATCH PROTECTOR 320 X 630
	Card Reader	1 Ea	Card reader by Others

# Hardware Schedule

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## Hardware Set 07

Water Entry Room Door

### Hardware Per Opening

<u>Door#</u>	<u>Keyed</u>	<u>area</u>	<u>x Egress area</u>	<u>Type</u>	<u>Size</u>	<u>Thk</u>	<u>Hand</u>	<u>Label</u>	<u>Door/Frame</u>	<u>Elev</u>
145	EXTERIOR	F	SPRINKLER	SGL	30 70	1 3/4	RHR	N/A	HMD x EXIST	G

Manufacturer		Qty	Description
IVES	Hinge - (4-1/2 Std Wt(.134))	3 Ea	5BB1 x 4.5 X 4.5 x NRP x 630
SCHLAG	Cyl. Lockset (with thru-bolts)	1 Ea	ND80GD x RHO x 13-247 X 10-025 X MK X 626
	Closer	1 Ea	4040XP X CUSH X SRT X AL
NGPFull	Weatherstrip	1 Ea	5050B X 17 X B
NGPFull	Sweep	1 Ea	200NA x 36
NGPFull	Threshold	1 Ea	803N x 36"
NGPFull	Drip Cap	1 Ea	DRIP CAP 16A X 40"
ROCKWO	Latch Guard	1 Ea	LATCH PROTECTOR 320 X 630

# Hardware Schedule

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## Hardware Set 08

Individual Restrooms

### Hardware Per Opening

<u>Door#</u>	<u>Keyed area</u>	<u>x Egress area</u>	<u>Type</u>	<u>Size</u>	<u>Thk</u>	<u>Hand</u>	<u>Label</u>	<u>Door/Frame</u>	<u>Elev</u>
101B	LOBBY	T RESTROOM	SGL	30 70	1 3/4	LH	N/A	WD x EXIST	C2
127	COR 126	T RESTROOM	SGL	30 70	1 3/4	LH	N/A	WD x HMF	C
128	COR 126	T RESTROOM	SGL	30 70	1 3/4	RH	N/A	WD x HMF	C

<u>Manufacturer</u>		<u>Qty</u>	<u>Description</u>
IVES	Hinge - (4-1/2 Std Wt(.134))	3 Ea	5BB1 X 4.5 X 4.5 X 626
SCHLAG	Privacy Set (with thru-bolts)	1 Ea	ND40S X RHO X 13-048 X 10-025 X 626
SCHLAG	Deadlock - Cylindrical	1 Ea	B571 X626
ROCKWO	Wall Stop	1 Ea	WALL STOP 409 X 630
IVES	Silencer	3 Ea	SR64 X GRY

# Hardware Schedule

The Arc of the Ozarks  
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## Hardware Set 09

Group Restrooms

### Hardware Per Opening

<u>Door#</u>	<u>Keyed</u>	<u>area</u>	<u>x Egress area</u>	<u>Type</u>	<u>Size</u>	<u>Thk</u>	<u>Hand</u>	<u>Label</u>	<u>Door/Frame</u>	<u>Elev</u>
133	COR 106	T	WOMEN'S RR	SGL	30 70	1 3/4	LH	N/A	WD x EXIST	C2
134	COR 106	T	MEN'S RR	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	C2

<u>Manufacturer</u>		<u>Qty</u>	<u>Description</u>
IVES	Hinge - (4-1/2 Std Wt(.134))	3 Ea	5BB1 X 4.5 X 4.5 X 626
ROCKWO	Push Plate	1 Ea	70C X US32D
ROCKWO	Pull Plate	1 Ea	107 X 70C X TYPE 1 X US32D
LCN	Closer	1 Ea	4040XP.RWPA.689 x 689
ROCKWO	Kick Plate	1 Ea	K1050 X 10" X 34" X US32D
ROCKWO	Wall Stop	1 Ea	WALL STOP 406 X 630
IVES	Silencer	3 Ea	SR64 X GRY

# Hardware Schedule

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## Hardware Set 10

Access Control Hall Doors

### Hardware Per Opening

<u>Door#</u>	<u>Keyed area</u>	<u>x Egress area</u>	<u>Type</u>	<u>Size</u>	<u>Thk</u>	<u>Hand</u>	<u>Label</u>	<u>Door/Frame</u>	<u>Elev</u>
101	ENTRY	F LOBBY	SGL/S	30 70	1 3/4	RHR	N/A	WD x EXIST	D2
102	LOBBY	F RECEPTION	SGL	30 70	1 3/4	LHR	N/A	WD x HMF	D
106	LOBBY	F COR 106	SGL	30 70	1 3/4	RHR	N/A	WD x HMF	D
109	COR 106	F COR 109	SGL	30 70	1 3/4	RHR	N/A	WD x EXIST	D2
115	COR 109	F PROGRAMS	SGL	30 70	1 3/4	LHR	N/A	WD x HMF	E
131	COR 106	F COR 131	SGL	30 70	1 3/4	RHR	N/A	WD x EXIST	D2

<u>Manufacturer</u>		<u>Qty</u>	<u>Description</u>
IVES	Hinge - (4-1/2 Std Wt(.134))	3 Ea	5BB1 X 4.5 X 4.5 X 626
SCHLAG	Cylinder - Rim	1 Ea	80-329 X 626
VON DUP	Exit Device - Rim	1 Ea	98L X 996L-NL(#06) X 299 X 3-0 X US26D
VON DUP	Electric Strike	1 Ea	6113 X 12VDC X FAIL SAFE X US32D
LCN	Closer	1 Ea	4040XP X HCUSH X SRT X AL
ROCKWO	Kick Plate	1 Ea	K1050 X 10" X 34" X US32D
ROCKWO	Wall Stop	1 Ea	WALL STOP 409 X 630
IVES	Silencer	3 Ea	SR64 X GRY

# Hardware Schedule

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## Hardware Set 11

Doors Off hallways

### Hardware Per Opening

<u>Door#</u>	<u>Keyed</u>	<u>area</u>	<u>x Egress area</u>	<u>Type</u>	<u>Size</u>	<u>Thk</u>	<u>Hand</u>	<u>Label</u>	<u>Door/Frame</u>	<u>Elev</u>
104	COR 106	T	ADMIN	SGL	30 70	1 3/4	LH	N/A	WD x EXIST	E2
104A	RECEPTION	F	ADMIN	SGL	30 70	1 3/4	LHR	N/A	WD x HMF	E
115A	PROGRAMS	T	WORK ROOM	SGL	30 70	1 3/4	RH	N/A	WD x HMF	C

<u>Manufacturer</u>		<u>Qty</u>	<u>Description</u>
IVES	Hinge - (4-1/2 Std Wt(.134))	3 Ea	5BB1 X 4.5 X 4.5 X 626
SCHLAG	Cyl. Lockset (with thru-bolts)	1 Ea	ND70GD x RHO x 13-247 X 10-025 X MK X 626
LCN	Closer	1 Ea	4040XP.RWPA.689 x 689
ROCKWO	Kick Plate	1 Ea	K1050 X 10" X 34" X US32D
ROCKWO	Wall Stop	1 Ea	WALL STOP 409 X 630
IVES	Silencer	3 Ea	SR64 X GRY



# Hardware Schedule

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## Hardware Set 11A

No Closer

### Hardware Per Opening

<u>Door#</u>	<u>Keyed area</u>	<u>x Egress area</u>	<u>Type</u>	<u>Size</u>	<u>Thk</u>	<u>Hand</u>	<u>Label</u>	<u>Door/Frame</u>	<u>Elev</u>
107	COR 106	T FUTURE	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	E2
108	COR 109	T ACTIVITY	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	E2
110	DAY PROGRAM	T SENSORY	SGL	30 70	1 3/4	RH	N/A	WD x HMF	E
110A	ACTIVITY	T SENSORY	SGL	30 70	1 3/4	LH	N/A	WD x HMF	E
114	COR 109	F DAY PROGRAM	SGL	30 70	1 3/4	RHR	N/A	WD x HMF	E
138	COR 106	T BREAK ROOM	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	D2

<u>Manufacturer</u>		<u>Qty</u>	<u>Description</u>
IVES	Hinge - (4-1/2 Std Wt(.134))	3 Ea	5BB1 X 4.5 X 4.5 X 626
SCHLAG	Cyl. Lockset (with thru-bolts)	1 Ea	ND70GD x RHO x 13-247 X 10-025 X MK X 626
ROCKWO	Kick Plate	1 Ea	K1050 X 10" X 34" X US32D
ROCKWO	Wall Stop	1 Ea	WALL STOP 409 X 630
IVES	Silencer	3 Ea	SR64 X GRY

Hardware Schedule

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Hardware Set 11B

Hardware Per Opening

<u>Door#</u>	<u>Keyed area</u>	<u>x Egress area</u>	<u>Type</u>	<u>Size</u>	<u>Thk</u>	<u>Hand</u>	<u>Label</u>	<u>Door/Frame</u>	<u>Elev</u>	
136	COR 106	T	TRAINING KITCH	SGL	30 70	1 3/4	RH	N/A	WD x EXIST	J

Manufacturer		Qty	Description
IVES	Hinge - (4-1/2 Std Wt(.134))	3 Ea	5BB1 X 4.5 X 4.5 X 626
SCHLAG	Cyl. Lockset (with thru-bolts)	1 Ea	ND70GD x RHO x 13-247 X 10-025 X MK X 626
ROCKWO	Armor Plate	1 Ea	K1050 X 36"H X 34"W X US32D
ROCKWO	Wall Stop	1 Ea	WALL STOP 409 X 630
IVES	Silencer	3 Ea	SR64 X GRY

# Hardware Schedule

The Arc of the Ozarks  
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## Hardware Set 13

### Hardware Per Opening

<u>Door#</u>	<u>Keyed area</u>	<u>x Egress area</u>	<u>Type</u>	<u>Size</u>	<u>Thk</u>	<u>Hand</u>	<u>Label</u>	<u>Door/Frame</u>	<u>Elev</u>	
137	COR 106	T	MAINTENANCE	SGL	30 70	1 3/4	LH	N/A	WD x EXIST	G

Manufacturer		Qty	Description
IVES	Hinge - (4-1/2 Std Wt(.134))	3 Ea	5BB1 X 4.5 X 4.5 X 626
SCHLAG	Cyl. Lockset (with thru-bolts)	1 Ea	ND80GD x RHO x 13-247 X 10-025 X MK X 626
LCN	Closer	1 Ea	4040XP.RWPA.689 x 689
ROCKWO	Kick Plate	1 Ea	K1050 X 10" X 34" X US32D
ROCKWO	Floor Stop	1 Ea	440 X 626
NGPFull	Weatherstrip	1 Ea	5050B X 17 X B
NGPFull	Sweep	1 Ea	C607A x 36"

# Hardware Schedule

The Arc of the Ozarks  
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Hardware Set N/A

Hardware Per Opening

<u>Door#</u>	<u>Keyed area</u>	<u>x Egress area</u>	<u>Type</u>	<u>Size</u>	<u>Thk</u>	<u>Hand</u>	<u>Label</u>	<u>Door/Frame</u>	<u>Elev</u>
136B	KITCHEN	@ TRAINING RM	SHUT	50 40	1 3/4	SLID	N/A	ALUM x ALUM B	

## **SECTION 088000 - GLAZING**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
  - 1. Windows.
  - 2. Doors.
  - 3. Glazed entrances.
  - 4. Interior borrowed lites.
  - 5. Storefront framing.

#### **1.2 DEFINITIONS**

- A. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.
- B. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.
- C. Deterioration of Insulating Glass: Failure of hermetic seal under normal use that is attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

#### **1.3 PERFORMANCE REQUIREMENTS**

- A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than

thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:

1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
  - a. Specified Design Wind Loads: not less than wind loads applicable to Project as required by ASCE 7 "Minimum Design Loads for Buildings and Other Structures": Section 6.0 "Wind Loads."
  - b. Probability of Breakage for Vertical Glazing: 8 lites per 1000 for lites set vertically or not more than 15 degrees off vertical and under wind action.
    - 1) Load Duration: 60 seconds or less.
  - c. Minimum Glass Thickness for Exterior Lites: Not less than 6.0 mm.
  - d. Thickness of Tinted and Heat-Absorbing Glass: Provide the same thickness for each tint color indicated throughout Project.
- C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
  1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified based on manufacturer's published test data, as determined according to procedures indicated below:
  1. For monolithic-glass lites, properties are based on units with lites 6.0 mm thick.
  2. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite 6.0 mm thick and a nominal 1/2-inch- wide interspace.
  3. Center-of-Glass Values: Based on using LBL-44789 WINDOW 5.0 computer program for the following methodologies:
    - a. U-Factors: NFRC 100 expressed as Btu/ sq. ft. x h x deg F.
    - b. Solar Heat Gain Coefficient: NFRC 200.
    - c. Solar Optical Properties: NFRC 300.

#### 1.4 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated.
- B. Samples: 12-inch- square, for each type of glass product indicated, other than monolithic clear float glass.
- C. Glazing Schedule: Use same designations indicated on Drawings.

- D. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer.

#### 1.5 QUALITY ASSURANCE

- A. Preconstruction Adhesion and Compatibility Testing: Submit to elastomeric glazing sealant manufacturers, for testing according to ASTM C 1087, samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that will contact or affect elastomeric glazing sealants:
- B. Glazing for Fire-Rated Door and Window Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.
- C. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201.
- D. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
  - 1. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."
- E. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the Insulating Glass Certification Council or Associated Laboratories, Inc.

#### 1.6 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer's standard form, made out to Owner and signed by coated-glass manufacturer agreeing to replace coated-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
  - 1. Warranty Period: 10 years from date of Substantial Completion.
- B. Manufacturer's Special Warranty on Insulating Glass: Manufacturer's standard form, made out to Owner and signed by insulating-glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

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

### 2.2 GLASS PRODUCTS

- A. Annealed Float Glass: ASTM C 1036, Type I (transparent flat glass), Quality-Q3; of class indicated.
- B. Heat-Treated Float Glass: ASTM C 1048; Type I (transparent flat glass); Quality-Q3; of class, kind, and condition indicated.
1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed, unless otherwise indicated.
  2. Provide Kind HS (heat-strengthened) float glass in place of annealed float glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
  3. For uncoated glass, comply with requirements for Condition A.
  4. For coated vision glass, comply with requirements for Condition C (other uncoated glass).
  5. Provide Kind FT (fully tempered) float glass in place of annealed or Kind HS (heat-strengthened) float glass where safety glass is indicated.
- C. Pyrolytic-Coated Float Glass: ASTM C 1376, float glass with metallic-oxide coating applied by pyrolytic deposition process during initial manufacture, and complying with other requirements specified. See Glass Types on Drawings also for specific rated glazing types indicated.
- D. Sputter-Coated Float Glass: ASTM C 1376, float glass with metallic-oxide or -nitride coating deposited by vacuum deposition process after manufacture and heat treatment (if any), and complying with other requirements specified.
- E. Wired Glass: ASTM C 1036, Type II (patterned and wired flat glass), Class 1 (clear), Quality-Q-6; and of form and mesh pattern specified.



- F. Insulating-Glass Units, General: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, and complying with ASTM E 774 for Class CBA units and with requirements specified in this Article and in Part 2 "Insulating-Glass Units" Article.
1. Provide Kind HS (heat-strengthened) float glass in place of annealed glass where needed to resist thermal stresses induced by differential shading of individual glass lites and to comply with glass design requirements specified in Part 1 "Performance Requirements" Article.
  2. Overall Unit Thickness and Thickness of Each Lite: Dimensions indicated for insulating-glass units are nominal and the overall thicknesses of units are measured perpendicularly from outer surfaces of glass lites at unit's edge.
  3. Sealing System: Dual seal.
  4. Spacer Specifications: Manufacturer's standard spacer material and construction.
  5. Spacer Specifications: Manufacturer's standard spacer material and construction complying with the following requirements:
    - a. Spacer Material: Aluminum with black, color anodic finish.
    - b. Corner Construction: Manufacturer's standard corner construction.

## 2.3 FIRE-RATED GLAZING PRODUCTS

- A. Fire-Protection Rating: As indicated for the assembly in which glazing material is installed, and permanently labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.

## 2.4 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
1. Neoprene, ASTM C 864.
  2. EPDM, ASTM C 864.
  3. Silicone, ASTM C 1115.
  4. Thermoplastic polyolefin rubber, ASTM C 1115.
  5. Any material indicated above.
- B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned gaskets of material indicated below; complying with ASTM C 509, Type II, black; and of profile and hardness required to maintain watertight seal:
1. Neoprene.
  2. EPDM.
  3. Silicone.
  4. Thermoplastic polyolefin rubber.
  5. Any material indicated above.

## 2.5 GLAZING SEALANTS

- A. General: Provide products of type indicated, complying with the following requirements:
  - 1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
  - 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
  - 3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Glazing Sealants for Fire-Resistive Glazing Products: Identical to products used in test assemblies to obtain fire-protection rating.

## 2.6 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
  - 1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
  - 2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; packaged on rolls with release liner protecting adhesive; and complying with AAMA 800 for the following types:
  - 1. Type 1, for glazing applications in which tape acts as the primary sealant.
  - 2. Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

## 2.7 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.
- G. Perimeter Insulation for Fire-Resistive Glazing: Identical to product used in test assembly to obtain fire-resistance rating.

## 2.8 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

## 2.9 INSULATING-GLASS UNITS

- A. Solar-Control Low-E Tinted Insulating-Glass Units, **GL-1** from window schedule and general notes:
  - 1. Products, Basis of Design:
    - a. ¼" Tinted Float Glass (***Tint color to match existing building 'Bronze/Gray' glazing tint color***) Field Verify glass color and submit samples to Owner/Architect for approval) + ¼" PPG Solarban 60, Low-E on 3rd surface, by PPG Industries, Inc.
  - 2. Overall Unit Thickness and Thickness of Each Lite: 1" or as otherwise indicated.
  - 3. Interspace Content: ½" Airspace or gas filled.
  - 4. Annealed and Tempered as indicated in drawings and as required by IBC 2012 code.
  - 5. Performance Standards:
    - a. Visible Light Transmittance: 64 percent.
    - b. Winter Nighttime U-Factor: .28 maximum.
    - c. Summer Daytime U-Factor: .26 maximum.
    - d. Solar Heat Gain Coefficient: .27 minimum
    - e. Shading Coefficient: 0.32
    - f. Outdoor Visible Reflectance: 12 percent.
    - g. Performance values may vary slightly per tint color match.

## PART 3 - EXECUTION

### 3.1 GLAZING

- A. General: Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
1. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
  2. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
  3. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate testing.
  4. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
  5. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
  6. Provide spacers for glass lites where length plus width is larger than 50 inches.
  7. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- B. Tape Glazing: Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
1. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
  2. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
  3. Apply heel bead of elastomeric sealant.
  4. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
  5. Apply cap bead of elastomeric sealant over exposed edge of tape.
- C. Gasket Glazing (Dry): Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
1. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

2. Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
  3. Install gaskets so they protrude past face of glazing stops.
- D. Sealant Glazing (Wet): Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
1. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
  2. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

### 3.2 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.
- B. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

**END OF SECTION 088000**

## **SECTION 088300 - MIRRORS**

### **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 the following types of silvered flat glass mirrors:
  - 1. Annealed monolithic glass mirrors.
- B. Related Sections:
  - 1. Division 08 Section "Glazing" for glass with reflective coatings used for vision and spandrel lites.
  - 2. Division 10 Section "Toilet & Bath Accessories" for metal-framed mirrors.

#### **1.3 SUBMITTALS**

- A. Product Data: For each type of product indicated.
  - 1. Mirrors. Include description of materials and process used to produce each type of silvered flat glass mirror specified that indicates sources of glass, glass coating components, edge sealer, and quality-control provisions.
- B. Product Certificates: For each type of mirror and mirror clips, from manufacturer.
- C. Maintenance Data: For mirrors to include in maintenance manuals.

#### **1.4 PRODUCTS- SILVERED FLAT GLASS MIRRORS**

- A. Glass Mirrors, General: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Arch Aluminum & Glass Co., Inc.
    - b. Avalon Glass and Mirror Company.
    - c. Binswanger Mirror; a division of Vitro America, Inc.

- d. D & W Incorporated
- e. Donisi Mirror Company.
- f. Gardner Glass, Inc.
- g. Gilded Mirrors, Inc.
- h. Guardian Industries.
- i. Head West.
- j. Independent Mirror Industries, Inc.
- k. Lenoir Mirror Company.
- l. Maran-Wurzell Glass & Mirror.
- m. National Glass Industries.
- n. Stroupe Mirror Co., Inc.
- o. Sunshine Mirror; Westshore Glass Corp.
- p. Virginia Mirror Company, Inc.
- q. Walker Glass Co., Ltd.
- r. Springfield Glass
- s. American Glass
- t. Bobrick
- u. Bradley Corp.

- B. Clear Glass: Mirror Quality: ultraclear (low-iron) float glass with a minimum 91 percent visible light transmission].

- 1. Nominal Thickness: 6.0 mm

#### 1.5 MISCELLANEOUS MATERIALS

- A. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.

#### 1.6 MIRROR HARDWARE

- A. Equal to products specified on Drawings & Equipment Schedules.
- B. Mirror Bottom Clips: Yes.
- C. Mirror Top Clips: Yes.
- D. Plated Steel Hardware: Formed-steel shapes with plated finish indicated.
  - 1. Profile: As indicated.
- E. Fasteners: Fabricated of same basic metal and alloy as fastened metal and matching it in finished color and texture where fasteners are exposed.
- F. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.
- B. Source Limitations for Mirrors: Obtain mirrors from single source from single manufacturer.
- C. Source Limitations for Mirror Accessories: Obtain mirror glazing accessories from single source.
- D. Glazing Publications: Comply with the following published recommendations:
  - 1. GANA's "Glazing Manual" unless more stringent requirements are indicated. Refer to this publication for definitions of glass and glazing terms not otherwise defined in this Section or in referenced standards.
  - 2. GANA Mirror Division's "Mirrors, Handle with Extreme Care: Tips for the Professional on the Care and Handling of Mirrors."

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.10 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which mirror manufacturer agrees to replace mirrors that deteriorate within specified warranty period. Deterioration of mirrors is defined as defects developed from normal use that are not attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions. Defects include discoloration, black spots, and clouding of the silver film.
  - 1. Warranty Period: Five years from date of Substantial Completion.



1.11 FABRICATION

- A. Mirror Sizes: To suit Project conditions, cut mirrors to final sizes and shapes as indicated on Drawings.

PART 2 - EXECUTION

2.1 INSTALLATION

- A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
- B. Provide a minimum air space of 1/8 inch (3 mm) between back of mirrors and mounting surface for air circulation between back of mirrors and face of mounting surface.
- C. Wall-Mounted Mirrors: Install mirrors with mirror hardware. Attach mirror hardware securely to mounting surfaces with **concealed** mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors. Install per manufacturer's written instructions for concealed mounting.

2.2 CLEANING AND PROTECTION

- A. Protect mirrors from breakage and contaminating substances resulting from construction operations.
- B. Do not permit edges of mirrors to be exposed to standing water.
- C. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.
- D. Wash exposed surface of mirrors not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash mirrors as recommended in writing by mirror manufacturer.

**END OF SECTION 088300**

## **SECTION 092216 - NON-STRUCTURAL METAL FRAMING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
  - 2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.
- B. Related Requirements:
  - 1. Division 05 Section "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.

#### **1.3 ACTION SUBMITTALS**

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

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Evaluation Reports: For dimpled steel studs and runners and firestop tracks, from ICC-ES.

### **PART 2 - PRODUCTS**

#### **2.1 PERFORMANCE REQUIREMENTS**

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

## 2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
  - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
  - 2. Protective Coating: ASTM A 653/A 653M, G60, hot-dip galvanized unless otherwise indicated.
- B. Studs and Runners: ASTM C 645.
  - 1. Steel Studs and Runners:
    - a. Minimum Base-Metal Thickness: **20 GA, unless noted otherwise on Drawings.**
    - b. Depth: As indicated on Drawings, which may include any of the following sizes: 3-5/8 inches, 6 inches, 4 inches, 2-1/2 inches, 1-5/8 inches. ***Drawings indicated multiple stud sizes and spacings.***
  - 2. Dimpled Steel Studs and Runners:
    - a. Minimum Base-Metal Thickness: **20 GA, unless noted otherwise on Drawings. 18 & 25 GA framing may also be indicated on Drawings.**
    - b. Depth: As indicated on Drawings, which may include any of the following sizes: 3-5/8 inches, 6 inches, 4 inches, 2-1/2 inches, 1-5/8 inches.
  - 3. 20 gauge, interior non-load bearing studs may require a heavier gauge thickness as required/shown on Drawings and/or as recommended by the manufacturer for the configurations, heights, and various conditions indicated and as may be required for a complete assembly. ***Comply with stud manufacturer’s published limiting height information.*** Provide adequate bracing, supports, anchors, clips (including slip and deflection type where required), headers, multiple members, etc. as may be required by the conditions as recommended by the manufacturer. See Wall Partition Types information on Drawings.
- C. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
  - 1. Minimum Base-Metal Thickness: As indicated on Drawings or 0.027 inch min.
- D. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch wide flanges.
  - 1. Depth: As indicated on Drawings.
  - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch thick, galvanized steel.
- E. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
  - 1. Minimum Base-Metal Thickness: As indicated on Drawings or 0.033-inch min.
  - 2. Depth: As indicated on Drawings.

- F. Resilient Furring Channels: 1/2-inch deep, steel sheet members designed to reduce sound transmission.
  - 1. Configuration: hat shaped.
- G. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.
  - 1. Depth: As indicated on Drawings.
  - 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch.
  - 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch diameter wire, or double strand of 0.048-inch) diameter wire.
- H. Z-Shaped Furring: With slotted or non-slotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.018 inch, and depth required to fit insulation thickness indicated.

## 2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch diameter wire, or double strand of 0.048-inch diameter wire.
- B. Hanger Attachments to Concrete:
  - 1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to **5** times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
    - a. Type: Post-installed, expansion anchor.
  - 2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to **10** times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- D. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.
- E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch and minimum 1/2-inch wide flanges.
  - 1. Depth: As indicated on Drawings – See Ceiling Types on Reflected Ceiling Plans.
- F. Furring Channels (Furring Members):

1. Cold-Rolled Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
  2. Steel Studs and Runners: ASTM C 645.
    - a. Minimum Base-Metal Thickness: As indicated on Drawings.
    - b. Depth: As indicated on Drawings.
  3. Dimpled Steel Studs and Runners: ASTM C 645.
    - a. Minimum Base-Metal Thickness: As indicated on Drawings.
    - b. Depth: As indicated on Drawings.
  4. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
    - a. Minimum Base-Metal Thickness: As indicated on Drawings.
  5. Resilient Furring Channels: 1/2-inch deep members designed to reduce sound transmission.
    - a. Configuration: hat shaped.
- G. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
1. Products: Subject to compliance with requirements, ***provide the products indicated on the Drawings*** or equivalent product by one of the following manufacturer’s:
    - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
    - b. Chicago Metallic Corporation; Drywall Grid System.
    - c. USG Corporation; Drywall Suspension System.

## 2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide one of the following:
1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
  2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
  - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

### 3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
  - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

### 3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
  - 1. Single-Layer Application: 24 inches o.c. unless otherwise indicated.
  - 2. Multilayer Application: 24 inches o.c. unless otherwise indicated.
  - 3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
  - 1. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
    - a. Install two studs at each jamb unless otherwise indicated.
    - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
  - 2. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
  - 3. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- E. Direct Furring:
  - 1. Screw to wood framing.
  - 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- F. Z-Furring Members:
  - 1. Erect insulation, specified in Division 07 Section "Thermal Insulation," vertically and hold in place with Z-furring members spaced 24 inches o.c.
  - 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
  - 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
- G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

### 3.5 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
  - 1. Hangers: 48 inches o.c.
  - 2. Carrying Channels (Main Runners): 48 inches o.c.

3. Furring Channels (Furring Members): 24 inches o.c.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
  1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
    - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
    - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
  3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  5. Do not attach hangers to steel roof deck.
  6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
  7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
  8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

**END OF SECTION 092216**



## **SECTION 092900 - GYPSUM BOARD**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Interior gypsum board.
  - 2. Gypsum board finishes.
- B. Related Requirements:
  - 1. Division 06 Section "Sheathing" for gypsum sheathing for exterior walls.
  - 2. Division 09 Section "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Samples: For the following products:
  - 1. Trim Accessories: Full-size Sample in 12-inch-long length for each trim accessory indicated.
  - 2. Textured Finishes (if indicated other than smooth finish): 24" x 24" min. sample for each textured finish indicated and on same backing indicated for Work.

#### **1.4 DELIVERY, STORAGE AND HANDLING**

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

#### **1.5 FIELD CONDITIONS**

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

### 2.2 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
- B. All gypsum board products shall be manufactured in the USA. No foreign manufactured gypsum board products are allowed.

### 2.3 INTERIOR GYPSUM BOARD

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. American Gypsum.
  - 2. CertainTeed Corp.
  - 3. Georgia-Pacific Gypsum LLC.
  - 4. Lafarge North America Inc.
  - 5. National Gypsum Company.
  - 6. PABCO Gypsum.
  - 7. Temple-Inland.
  - 8. USG Corporation.
- B. Gypsum Wallboard: ASTM C 1396/C 1396M.
  - 1. Thickness: 5/8 inch or as indicated on Drawings.
  - 2. Long Edges: Tapered.
- C. Gypsum Board, Type X: ASTM C 1396/C 1396M.

1. Thickness: 5/8 inch .
2. Long Edges: Tapered.

D. Gypsum Ceiling Board: ASTM C 1396/C 1396M.

1. Thickness: 1/2 inch min. or as indicated on Drawings.
2. Long Edges: Tapered.

E. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.

1. Core: As indicated on Drawings: 1/2 inch, regular type and 5/8 inch, Type X.
2. Long Edges: Tapered.
3. Mold Resistance: ASTM D 3273, score of 10.

## 2.4 SPECIALTY GYPSUM BOARD

A. Gypsum Board, Type C: ASTM C 1396/C 1396M. Manufactured to have increased fire-resistive capability.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. American Gypsum; Firebloc Type C.
  - b. CertainTeed Corp.; ProRoc Type C.
  - c. Georgia-Pacific Gypsum LLC; Fireguard C.
  - d. Lafarge North America Inc.; Firecheck Type C.
  - e. National Gypsum Company; Gold Bond Fire-Shield C.
  - f. PABCO Gypsum; Flame Curb Type Super C.
  - g. Temple-Inland; Type TG-C.
  - h. USG Corporation; Firecode C Core.
2. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
3. Long Edges: Tapered.

## 2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
2. Shapes:
  - a. Cornerbead.
  - b. Bullnose bead.
  - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
  - d. L-Bead: L-shaped; exposed long flange receives joint compound.

- e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
- f. Expansion (control) joint.
- g. Curved-Edge Cornerbead: With notched or flexible flanges.

## 2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
  - 1. Interior Gypsum Board: Paper.
  - 2. Exterior Gypsum Soffit Board: Paper.
  - 3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
  - 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
  - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
    - a. Use setting-type compound for installing paper-faced metal trim accessories.
  - 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
  - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
  - 5. Skim Coat (Only where indicated on Drawings): For final coat of Level 5 finish, use drying-type, all-purpose compound or high-build interior coating product designed for application by airless sprayer and to be used instead of skim coat to produce Level 5 finish.

## 2.7 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
  - 1. Laminating adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Laminating adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
  2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
  2. Recycled Content of Blankets: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 20 percent.
- E. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
1. Products: Subject to compliance with requirements, provide one of the following available products:
    - a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
    - b. Grabber Construction Products; Acoustical Sealant GSC.
    - c. Pecora Corporation; AC-20 FTR or AIS-919.
    - d. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
    - e. USG Corporation; SHEETROCK Acoustical Sealant.
  2. Acoustical joint sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  3. Acoustical joint sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- F. Thermal Insulation: As specified in Division 07 Section "Thermal Insulation."
- G. Vapor Retarder: As specified in Division 07 Section "Thermal Insulation."
- 2.8 GYPSUM BOARD FINISHES
- A. Primer: As recommended by textured finish manufacturer.
  - B. Finish on all gypsum board shall be: **Smooth**.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc., except in chases braced internally).
  - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
  - 2. Fit gypsum panels around ducts, pipes, and conduits.
  - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

### 3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
  - 1. Wallboard Type: ***As indicated on Drawings.***
  - 2. Type X: ***As indicated on Drawings, Wall Types, and at all locations where required for fire-resistance-rated assemblies indicated.***
  - 3. Ceiling Type: ***As indicated on Drawings.***
  - 4. Moisture- and Mold-Resistant Type: ***As indicated on Drawings and at all Restroom wall locations.***
  - 5. Type C: ***Only as indicated on Drawings and where required for specific U.L. fire-resistance-rated assembly indicated.***
- B. Single-Layer Application:
  - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
  - 2. On partitions/walls, apply gypsum panels ***vertically*** unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
  - 3. On Z-furring members, apply gypsum panels horizontally (perpendicular to framing) with no end joints. Locate edge joints over furring members.
  - 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

### 3.4 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: ***Install control joints at locations indicated on Drawings, as directed by the Architect in the field, according to ASTM C 840 and in specific locations approved by Architect for visual effect. Schedule a meeting with the Architect to review locations prior to placement. Utilize USG Good Design Practices for placing expansion/control joints in drywall. See General Floor Plan Notes also.***
- C. Interior Trim: Install in the following locations:
  - 1. Cornerbead: Use at outside corners unless otherwise indicated.
  - 2. LC-Bead: Use where indicated/required.
  - 3. L-Bead: Use where indicated/required.
  - 4. U-Bead: Use where indicated/required.
  - 5. Curved-Edge Cornerbead: Use at curved openings.
- D. Aluminum Trim: Install in locations where indicated on Drawings.

### 3.5 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
  - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
  - 2. Level 2: Panels that are substrate for tile.
  - 3. Level 3: Where indicated on Drawings.
  - 4. Level 4: At all panel surfaces that will be exposed to view unless otherwise indicated.
    - a. Primer and its application to surfaces are specified in other Division 09 Sections.
  - 5. Level 5: Where indicated on Drawings and at all Curved gypsum board surfaces.
    - a. Primer and its application to surfaces are specified in other Division 09 Sections.



- E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
- F. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

### 3.6 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

### END OF SECTION 092900

## **SECTION 093000 - TILING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Ceramic/porcelain/glass tile (floor, wall and base).
  - 2. Crack isolation membrane.
  - 3. Metal edge strips.
- B. Related Sections:
  - 1. Division 07 Section "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

#### **1.3 DEFINITIONS**

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in "American National Standard Specifications for Installation of Ceramic Tile."
- C. Module Size: Actual tile size plus joint width indicated.
- D. Face Size: Actual tile size, excluding spacer lugs.

#### **1.4 PERFORMANCE REQUIREMENTS**

- A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
  - 1. Level Surfaces: MINIMUM static coefficient of friction must be greater than 0.8 dry and greater than 0.6 wet

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection: For each type of tile and grout indicated. Include Samples of accessories involving color selection.
- C. Samples for Verification:
  - 1. Full-size units of each type and composition of tile and for each color and finish required. For ceramic mosaic tile in color blend patterns, provide full sheets of each color blend.
  - 2. Full-size units of each type of trim and accessory for each color and finish required.
  - 3. Metal edge strips in 6-inch (150-mm) lengths.

1.6 QUALITY ASSURANCE

- A. Source Limitations for Tile: Obtain tile of each type and color or finish from one source or producer.
  - 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from one manufacturer and each aggregate from one source or producer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer for each product:
  - 1. Crack isolation membrane.
  - 2. Joint sealants.
  - 3. Metal edge strips.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.
- E. Handle tile that has temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

1.9 EXTRA MATERIALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Tile and Trim Units: Furnish quantity of full-size units equal to **One (1)** percent of amount installed for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
  - 1. Provide tile complying with Standard grade requirements unless otherwise indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.

2.2 TILE PRODUCTS

- A. Manufacturer/Products: Subject to compliance with requirements, provide the following: ***products by the manufacturers indicated on the Drawings*** or a equivalent approved product:

**TILE**

**SEE FINISH SCHEDULES FOR TILE TYPES.**

**GROUT**

**SEE FINISH SCHEDULES FOR GROUT TYPES.**

- B. Comparable Product Requests: Submit three (3) copies of each request for Architect’s consideration. Identify product or fabrication or installation method to be replaced. Include specification Section number and title and Drawing number and titles.
1. Comparable product by one of the following:
    - a. American Olean; Division of Dal-Tile International Inc.
    - b. Daltile; Division of Dal-Tile International Inc.
  2. Architect’s Action: If necessary, Architect will request additional information or documentation for evaluation within seven (7) days of receipt of a comparable product request. Architect will notify the Contractor of approval or rejection of proposed comparable product request within fifteen (15) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.
  3. Form of Approval: As specified in Division 1 Section “Submittal Procedures”.
  4. Use of product specified if Architect cannot make a decision on use of a comparable product request within time allocated.
  5. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining tile. Provide shapes as required from among the manufacturer's standard shapes as follows:
    - a. Wainscot Cap for Thin-Set Mortar Installations.

## 2.3 CRACK ISOLATION MEMBRANE

- A. General: Manufacturer's standard product, selected from the following, that complies with ANSI A118.12 for high performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.
- B. Fluid-Applied Membrane: Liquid-latex rubber or elastomeric polymer.
1. Products: Subject to compliance with requirements, provide the following available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Bostik, Inc.; Durabond D-222 Duraguard Membrane, Hydroment Gold.
    - b. C-Cure; CureLastic 949, Pro-Red Waterproofing Membrane 963.
    - c. Custom Building Products; Redgard Waterproofing and Crack Prevention Membrane, FractureFree Crack Prevention Membrane, Semco Crack Prevention Membrane.
    - d. Jamo Inc.; Waterproof.
    - e. Mer-Kote Products, Inc.; Fracture-Guard 5000.
    - f. Southern Grouts & Mortars, Inc.; Southcrete 1100 Crack Suppression and Waterproofing.
    - g. TEC; a subsidiary of H. B. Fuller Company; HydraFlex - Waterproofing Crack Isolation Membrane.

- C. Latex-Portland Cement: Flexible mortar consisting of cement-based mix and latex additive.
  - 1. Products: Subject to compliance with requirements, provide the following available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. C-Cure; UltraCure 971.
    - b. MAPEI Corporation; Mapelastic (PRP 315).
    - c. TEC; a subsidiary of H. B. Fuller Company; Triple Flex Waterproofing, Crack Isolation Membrane & Mortar.

## 2.4 SETTING MATERIALS

- A. Dry-Set Portland Cement Mortar (Thin Set): ANSI A118.1. **or Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.** Provide product that is approved by manufacturer for application thickness to allow flush finished tile height to be flush with adjacent finished surface materials, typically 5/8 inch (16 mm) – Confirm for specific project conditions.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Boiardi Products; a QEP company.
    - b. Bonsal American; an Oldcastle company.
    - c. Bostik, Inc.
    - d. C-Cure.
    - e. Custom Building Products.
    - f. Jamo Inc.
    - g. Laticrete International, Inc.
    - h. MAPEI Corporation.
    - i. Mer-Kote Products, Inc.
    - j. Southern Grouts & Mortars, Inc.
    - k. Summitville Tiles, Inc.
    - l. TEC; a subsidiary of H. B. Fuller Company.
  - 3. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
  - 4. Provide prepackaged, dry-mortar mix combined with acrylic resin, or styrene-butadiene-rubber liquid-latex additive at Project site.
  - 5. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4. Some manufacturers recommend medium-bed mortars although ANSI A118.4 does not contain any requirements distinguishing medium-bed mortars from other latex-portland cement mortars.

## 2.5 GROUT MATERIALS

- A. High Performance Cement Grout: ANSI A118.7.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturer as indicated on the Drawings.

## 2.6 ELASTOMERIC SEALANTS

- A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 07 Section "Joint Sealants."
  - 1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Use primers, backer rods, and sealant accessories recommended by sealant manufacturer.
- B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints unless otherwise indicated.
- C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
  - 1. Products: Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. DAP Inc.; Titanium Enriched Kitchen and Bath Sealant, 100 percent Silicone Kitchen and Bath Sealant.
    - b. Dow Corning Corporation; Dow Corning 786.
    - c. GE Silicones; a division of GE Specialty Materials; Sanitary 1700.
    - d. Laticrete International, Inc.; Latasil Tile & Stone Sealant.
    - e. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
    - f. Tremco Incorporated; Tremsil 600 White.

## 2.7 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring

applications; half-hard brass, white zinc alloy, nickel silver, stainless-steel, ASTM A 666, 300 Series exposed-edge material.

## 2.8 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
  - 1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
  - 2. Verify that concrete substrates for tile floors installed with adhesives, bonded mortar bed or thin-set mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.
    - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
    - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
  - 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
  - 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.



### 3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with adhesives or thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot (1:50) toward drains.
- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.
- D. Field-Applied Temporary Protective Coating: If indicated under tile type or needed to prevent grout from staining or adhering to exposed tile surfaces, precoat them with continuous film of temporary protective coating, taking care not to coat unexposed tile surfaces.

### 3.3 TILE INSTALLATION

- A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
  - 1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:
    - a. Exterior tile floors.
    - b. Tile floors in wet areas.
    - c. Tile swimming pool decks.
    - d. Tile floors in laundries.
    - e. Tile floors composed of tiles 8 by 8 inches (200 by 200 mm) or larger.
    - f. Tile floors composed of rib-backed tiles.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to

minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.

E. Joint Widths: Unless otherwise indicated, install tile with the following maximum joint widths:

1. Ceramic Mosaic Tile: 1/16 inch (1.6 mm).
2. Quarry Tile: 1/4 inch (6.35 mm).
3. Paver Tile: 1/4 inch (6.35 mm).
4. Glazed Wall Tile: 1/16 inch (1.6 mm).
5. Decorative Thin Wall Tile: 1/16 inch (1.6 mm).

Alert the interior designer if specific tile does not allow for these joint widths prior to installation.

F. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.

G. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.

1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."

H. Metal Edge Strips: Install at locations indicated, where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile, where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with or below top of tile and no threshold is indicated. This metal edge strip is the preferred threshold type between transition between tile and other floor finishes.

### 3.4 CRACK ISOLATION MEMBRANE INSTALLATION

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness and bonded securely to substrate.
- B. Do not install tile or setting materials over crack isolation membrane until membrane has cured.

### 3.5 CLEANING AND PROTECTING

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
  - 1. Remove epoxy and latex-portland cement grout residue from tile as soon as possible.
  - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
  - 3. Remove temporary protective coating by method recommended by coating manufacturer and that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent drain clogging.
- B. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- D. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

### 3.6 INTERIOR TILE INSTALLATION SCHEDULE

- A. Interior Floor Installations, Concrete Subfloor:
  - 1. Tile Installation F125A: Thin-set mortar on crack isolation membrane; TCA F125A, at typical concrete floors.
    - a. Tile Type: As indicated on the Drawings.
    - b. Thin-Set Mortar: Latex-, or latex- portland cement mortar.
    - c. Grout: Standard sanded cement, Standard unsanded cement, Polymer-modified sanded, Polymer-modified unsanded or Water-cleanable epoxy grout. Present BEST products to the Architect based on specific project considerations prior to installation.
- B. Interior Wall Installations, Metal Studs or Furring:
  - 1. Tile Installation W243: Thin-set mortar on gypsum board; TCA W243. – **at typical gypsum wall construction.**
    - a. Tile Type: As indicated on Drawings.
    - b. Thin-Set Mortar: Dry-set or Latex- portland cement mortar.
    - c. Grout: Sanded Portland Cement grout.

Present BEST products to the Architect based on specific project considerations prior to installation.

**END OF SECTION 093000**

## SECTION 095123 - ACOUSTICAL TILE CEILINGS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Acoustical tiles for ceilings.
  - 2. Concealed suspension systems.
- B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

#### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product specified.
- B. Samples for Initial Selection and/or Verification: For each component indicated and for each exposed finish required, prepared on Samples of 6-inches in size minimum or as indicated below.
  - 1. Acoustical Tile: Set of full-size Samples of each type, color, pattern, and texture.
  - 2. Concealed Suspension-System Members: 6-inch long Sample of each type.
  - 3. Exposed Moldings and Trim: Set of 6-inch long Samples of each type and color.

#### 1.4 CLOSEOUT SUBMITTALS

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

#### 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Acoustical Ceiling Units: **4 Full cartons of each type of ceiling tile types installed.**

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to the National Voluntary Laboratory Accreditation Program (NVLAP) for testing indicated.
- B. Installer Qualifications: Engage an experienced installer who has successfully completed acoustical ceilings similar in material, design, and extent to those indicated for this Project.

1.7 DELIVERY, STORAGE, AND HANDLING

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

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical tile ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
  - 1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical tile ceiling installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame-Spread Index: Comply with ASTM E 1264 for Class A materials.
  - 2. Smoke-Developed Index: 50 or less.
- B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

## 2.2 ACOUSTICAL TILES, GENERAL

- A. Source Limitations:
  - 1. Acoustical Ceiling Tile: Obtain each type from single source from single manufacturer.
  - 2. Suspension System: Obtain each type from single source from single manufacturer.
- B. Acoustical Tile Standard: Provide manufacturer's standard tiles of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
  - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.
- C. Acoustical Tile Colors and Patterns: Match appearance characteristics indicated for each product type.
  - 1. Where appearance characteristics of acoustical tiles are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

## 2.3 ACOUSTICAL TILES

- A. Basis-of-Design Product: Subject to compliance with requirements, **provide products indicated on Drawings (See Ceiling Types on Reflected Ceiling Plan Sheets)** or equivalent product indicated by one of the following:
  - 1. Armstrong World Industries, Inc.
  - 2. CertainTeed Corp.
  - 3. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Color: As indicated on Drawings & Ceiling Types.
- C. Edge/Joint Detail: As indicated on Drawings & Ceiling Types.
- D. Thickness: As indicated on Drawings.
- E. Modular Size: As indicated on Drawings & Ceiling Types.
- F. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical tiles treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21.

## 2.4 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension-System Standard: Provide manufacturer's standard metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.
- B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
  - 1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to **five** times that imposed by ceiling construction, as determined by testing according to ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
    - a. Type: Postinstalled expansion anchors.
    - b. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 for Class SC 1 service condition.
    - c. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Group 1 Alloy 304 or 316 for bolts; Alloy 304 or 316 for anchors.
  - 2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to **10** times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.
- C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
  - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
  - 2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire but provide not less than **12 gauge** wire.
- D. Hanger Rods: Mild steel, zinc coated or protected with rust-inhibitive paint.
- E. Angle Hangers: Angles with legs not less than 7/8 inch wide; formed with 0.04-inch thick, galvanized-steel sheet complying with ASTM A 653/A 653M, G90 coating designation; with bolted connections and 5/16-inch diameter bolts.

## 2.5 METAL SUSPENSION SYSTEM

- A. Basis-of-Design Product: Subject to compliance with requirements, **provide products indicated on Drawings (See Ceiling Types on Reflected Ceiling Plan Sheets)** or equivalent product indicated by one of the following:
  - 1. Armstrong World Industries, Inc.



2.     USG Interiors, Inc.; Subsidiary of USG Corporation.
3.     CertainTeed Corp.
4.     Chicago Metallic Corporation.

## 2.6       METAL EDGE MOLDINGS AND TRIM

- A.     Basis-of-Design Product:   Subject to compliance with requirements, **provide products indicated on Drawings (See *Ceiling Types on Reflected Ceiling Plan Sheets*)** or equivalent product by one of the following:
1.     Armstrong World Industries, Inc.
  2.     USG Interiors, Inc.; Subsidiary of USG Corporation.
  3.     CertainTeed Corp.
  4.     Chicago Metallic Corporation.
- B.     Roll-Formed, Sheet-Metal Edge Moldings and Trim:   Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations complying with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
1.     Provide manufacturer's standard edge moldings that fit acoustical tile edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated.
  2.     For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
- C.     Extruded-Aluminum Edge Moldings and Trim:   Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips and complying with seismic design requirements and the following:
1.     Aluminum Alloy:   Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated and with not less than the strength and durability properties of aluminum extrusions complying with ASTM B 221 for Alloy and Temper 6063-T5.
  2.     Clear Anodic Finish:   AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.
  3.     Baked-Enamel or Powder-Coat Finish:   Minimum dry film thickness of 1.5 mils. Comply with ASTM C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

## 2.7       ACOUSTICAL SEALANT

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

2. Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant.
3. Acoustical sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing and substrates to which acoustical tile ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine acoustical tiles before installation. Reject acoustical tiles that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Testing Substrates: Before installing adhesively applied tiles on wet-placed substrates such as cast-in-place concrete or plaster, test and verify that moisture level is below tile manufacturer's recommended limits.
- B. Measure each ceiling area and establish layout of acoustical tiles to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width tiles at borders, and comply with layout shown on reflected ceiling plans.

#### 3.3 INSTALLATION OF SUSPENDED ACOUSTICAL TILE CEILINGS

- A. General: Install acoustical panel ceilings according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
  1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
  2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.

4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
  5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
  6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
  7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
  8. Do not attach hangers to steel deck tabs.
  9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
  11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical tile ceiling area and where necessary to conceal edges of acoustical tiles.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
  2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
  3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Arrange directionally patterned acoustical tiles as follows:
1. As indicated on reflected ceiling plans or as directed by Architect.
- G. Install acoustical tiles in coordination with suspension system and exposed moldings and trim. Place splines or suspension-system flanges into kerfed edges so tile-to-tile joints are closed by double lap of material.

1. Fit adjoining tile to form flush, tight joints. Scribe and cut tile for accurate fit at borders and around penetrations through tile.
2. Hold tile field in compression by inserting leaf-type, spring-steel spacers between tile and moldings, spaced 12 inches o.c.
3. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

#### 3.4 CLEANING

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

**END OF SECTION 095123**

## **SECTION 096500 - RESILIENT FLOORING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Solid Enhanced Vinyl Floor Tile (EVT).
  - 2. Rubber Floor Tile (RF).
  - 3. Sheet Vinyl Flooring (SV).
  - 4. Vinyl Composition Floor Tile (VCT).
- B. Related Sections:
  - 1. Division 09 Section "Resilient Base and Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor coverings.

#### **1.3 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
  - 1. Show details of special patterns.
- C. Samples for Initial Selection: For each type of floor tile indicated.
- D. Samples for Verification: Full-size units of each color and pattern of floor tile required.
  - 1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.
- E. Seam Samples: For seamless-installation technique indicated and for each flooring product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to a rigid backing and prepared by Installer for this Project.
- F. Product Schedule: For floor tile. Use same designations indicated on Drawings.
- G. Qualification Data: For qualified Installer.

- H. Maintenance Data: For each type of floor tile to include in maintenance manuals.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.
  - 1. Engage an installer who employs workers for this Project who are trained or certified by manufacturer for installation techniques required.
- B. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
  - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.
- C. Mockups: Build “loose laid” mockups in locations where special patterns are indicated to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Build mockups for floor tile including resilient base and accessories.
    - a. Size: Minimum 100 sq. ft. for each type, color, and pattern in locations where special patterns are indicated and/or directed by Architect.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

#### 1.6 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.

- E. Install floor tile after other finishing operations, including painting, have been completed.

#### 1.7 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Floor Tile: Furnish 1 box for every **50** boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

### PART 2 - PRODUCTS

#### 2.1 SOLID ENHANCED VINYL FLOOR TILE (EVT)

- A. Products: Subject to compliance with requirements, ***provide the products indicated on the Drawings, Finish Floor Plans & Finish Schedules***, or equivalent products from one of the following:
  - 1. Altro Group.
  - 2. Amtico Studio (The), Amtico International Inc..
  - 3. Armstrong World Industries, Inc..
  - 4. Burke Mercer Flooring Products, Division of Burke Industries Inc..
  - 5. Estrie Products International, American Biltrite (Canada) Ltd..
  - 6. Flexco.
  - 7. Gemtec Inc..
  - 8. Gerflor, Architectural Floor Systems, Inc..
  - 9. Johnsonite >.
  - 10. Polyflor, Ltd., Distributed by Gerbert Limited.
  - 11. Roppe Corporation, USA.
  - 12. Tarkett, Inc..
  - 13. TOLI International.
  - 14. VPI, LLC, Floor Products Division.
- B. Tile Standard: ASTM F 1700.
  - 1. Class: As indicated by product designations.
  - 2. Type: Type A, smooth surface.
- C. Thickness: As scheduled/indicated on Drawings.
- D. Size: As scheduled/indicated on Drawings.
- E. Seaming Method: Heat welded or Chemically bonded as recommended by the Manufacturer.
- F. Colors and Patterns: As scheduled/indicated on Drawings or as selected by Architect from full range of industry colors.

2.2 RUBBER FLOOR TILE (RF)

- A. Products: Subject to compliance with requirements, ***provide the products indicated on the Drawings, Finish Floor Plans & Finish Schedules***, or equivalent products from one of the following:
1. Burke Mercer Flooring Products, Division of Burke Industries Inc..
  2. Endura Rubber Flooring, a division of Burke Industries Inc..
  3. Estrie Products International, American Biltrite (Canada) Ltd..
  4. Flexco.
  5. Johnsonite.
  6. Mondo Rubber International, Inc..
  7. Nora Rubber Flooring, Freudenberg Building Systems, Inc..
  8. PRF USA Inc..
  9. R.C.A. Rubber Company (The).
  10. Roppe Corporation, USA.
  11. Capri Cork.
- B. Tile Standard: ASTM F 1344, As scheduled/indicated on Drawings – type varies, see Drawings & Finish Schedules.
- C. Hardness: As scheduled/indicated on Drawings – type varies, see Drawings & Finish Schedules.
- D. Wearing Surface: As scheduled/indicated on Drawings – type varies, see Drawings & Finish Schedules.
- E. Thickness: As scheduled/indicated on Drawings – type varies, see Drawings & Finish Schedules.
- F. Size: As scheduled/indicated on Drawings – type varies, see Drawings & Finish Schedules.
- G. Seaming Method: As recommended in writing by the manufacturer.
- H. Colors and Patterns: As scheduled/indicated on Drawings, or as selected by Architect from full range of industry colors – type varies, see Drawings & Finish Schedules.

2.3 SHEET VINYL FLOORING (SV).

- A. Products: Subject to compliance with requirements, ***provide the products indicated on the Drawings, Finish Floor Plans & Finish Schedules***, or equivalent products from one of the following:
1. Armstrong World Industries, Inc.
  2. Johnsonite.
  3. Tarkett, Inc.
- B. Thickness: As scheduled/indicated on Drawings.
- C. Size: As scheduled/indicated on Drawings.



- D. Seaming Method: Heat welded as recommended by the Manufacturer, color/pattern match rod per Finish Schedule.
- E. Colors and Patterns: As scheduled/indicated on Drawings or as selected by Architect from full range of industry colors. Pattern / color weld rod – color to match.

#### 2.4 VINYL COMPOSITION FLOOR TILE (VCT)

- A. Products: Subject to compliance with requirements, ***provide the products indicated on the Drawings, Finish Floor Plans & Finish Schedules***, or equivalent products from one of the following:
  - 1. Armstrong World Industries, Inc.
  - 2. Mannington Mills, Inc.
  - 3. Tarkett, Inc.
  - 4. Johnsonite.
- B. Tile Standard: ASTM F 1066, As scheduled/indicated on Drawings – type varies, see Drawings & Finish Schedules.
- C. Wearing Surface: As scheduled/indicated on Drawings – type varies, see Drawings & Finish Schedules.
- D. Thickness: As scheduled/indicated on Drawings – type varies, see Drawings & Finish Schedules.
- E. Size: As scheduled/indicated on Drawings – type varies, see Drawings & Finish Schedules.
- F. Colors and Patterns: As scheduled/indicated on Drawings, or as selected by Architect from full range of industry colors – type varies, see Drawings & Finish Schedules.

#### 2.5 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated.
  - 1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
    - a. VCT and Asphalt Tile Adhesives: Not more than 50 g/L.
    - b. Rubber Floor Adhesives: Not more than 60 g/L.
- C. Seamless-Installation Accessories:
  - 1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.

- a. Color: As scheduled or as selected by Architect from manufacturer's full range of colors.
- 2. Chemical-Bonding Compound: Manufacturer's product for chemically bonding seams.
  - a. Use chemical-bonding compound that has a VOC content of 350 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- D. Floor Polish: Provide two (2) or more coats of protective liquid floor polish products as recommended by manufacturer.
- E. Joint Sealant for Terrazzo Floor Tile: Silicone sealant of type and grade as recommended in writing by manufacturer to suit resilient terrazzo floor tile.
  - 1. Use sealant that has a VOC content of not more than 250 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Joint-Sealant Color: Match floor tile.
- F. Sealers and Finish Coats for Resilient Floor Tile: Provide two (2) or more coats of Premium-type products as recommended by manufacturer for resilient floor tile.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
  - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
  - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.

4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
  - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
  - b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.
- C. Access Flooring Panels: Remove protective film of oil or other coating using method recommended by access flooring manufacturer.
- D. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- E. Do not install floor tiles until they are same temperature as space where they are to be installed.
  1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- F. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

### 3.3 FLOOR TILE INSTALLATION

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

- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
- G. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in finished floor areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- H. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- I. Seamless Installation:
  - 1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and heat weld with welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces.

### 3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
  - 1. Remove adhesive and other blemishes from exposed surfaces.
  - 2. Sweep and vacuum surfaces thoroughly.
  - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor tile surfaces before applying liquid floor polish.
  - 1. Apply two (2) coat(s) or more if recommended by the Manufacturer.
- E. Joint Sealant: Apply sealant to resilient terrazzo floor tile perimeter and around columns, at door frames, and at other joints and penetrations.
- F. Sealers and Finish Coats: Remove soil, visible adhesive, and surface blemishes from resilient terrazzo floor tile surfaces before applying liquid cleaners, sealers, and finish products.
  - 1. Sealer: Apply two base coats of liquid sealer.
  - 2. Finish: Apply two (2) coat(s) of liquid floor finish or more if recommended by the Manufacturer.

- G. Cover floor tile until Substantial Completion.

**END OF SECTION 096500**

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

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Resilient base and accessories.

#### **1.3 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Samples for Initial Selection/Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches long, of each resilient product color, texture, and pattern required.
- C. Product Schedule: For resilient products. Use same designations indicated on Drawings.

#### **1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

#### **1.5 PROJECT CONDITIONS**

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

- C. Install resilient products after other finishing operations, including painting, have been completed.

## 1.6 EXTRA MATERIALS

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

## PART 2 - PRODUCTS

### 2.1 RESILIENT BASE

- A. Resilient Base:
  - 1. Manufacturers: Subject to compliance with requirements, ***provide the products indicated on the Drawings & Finish Schedules: See Finish Floor Schedules/Plans for base types***, or equivalent products by one of the following:
    - a. Allstate Rubber Corp.; Stoler Industries.
    - b. Armstrong World Industries, Inc.
    - c. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
    - d. Endura Rubber Flooring; Division of Burke Industries, Inc.
    - e. Estrie Products International; American Biltrite (Canada) Ltd.
    - f. Flexco, Inc.
    - g. Johnsonite.
    - h. Mondo Rubber International, Inc.
    - i. Musson, R. C. Rubber Co.
    - j. Nora Rubber Flooring; Freudenberg Building Systems, Inc.
    - k. PRF USA, Inc.
    - l. Roppe Corporation, USA.
    - m. VPI, LLC; Floor Products Division.
- B. Resilient Base Standard: ASTM F 1861.
  - 1. Material Requirement: Type TS (vinyl, vulcanized thermoset).
  - 2. Style: Cove (base with toe) and/or Straight (flat or toeless) as scheduled.
- C. Minimum Thickness: 0.125 inch.
- D. Height: 4 inches as indicated on Drawings.
- E. Lengths: 4' lengths.
- F. Outside Corners: Job formed.

- G. Inside Corners: Job formed.
- H. Finish: As selected by Architect from manufacturer's full range.
- I. Colors and Patterns: As indicated on Drawings and Finish Schedules.

## 2.2 RESILIENT MOLDING ACCESSORY

- A. Resilient Molding Accessory:
  - 1. Manufacturers: Subject to compliance with requirements, ***provide the products indicated on the Drawings & Finish Schedules/Plans: See Finish Floor Schedules/Plans for base types***, or equivalent products by one of the following:
    - a. Burke Mercer Flooring Products; Division of Burke Industries, Inc.
    - b. Flexco, Inc.
    - c. Johnsonite.
    - d. R.C.A. Rubber Company (The).
    - e. Roppe Corporation, USA.
    - f. VPI, LLC; Floor Products Division.
- B. Description: Carpet edge for glue-down applications, Nosing for carpet, [Nosing for resilient floor covering, Reducer strip for resilient floor covering, Joiner for tile and carpet, and Transition strips.
- C. Material: Vinyl.
- D. Profile and Dimensions: As indicated/scheduled on Drawings and Finish Schedules.
- E. Colors and Patterns: As indicated/scheduled on Drawings and Finish Schedules.

## 2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
  - 1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
    - a. Cove Base Adhesives: Not more than 50 g/L.
    - b. Rubber Floor Adhesives: Not more than 50 g/L.
    - c. Follow manufacturer’s instruction for surface preparation, application, and clean up.



## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Base and Accessories:
  - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient products until they are same temperature as the space where they are to be installed.
  - 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

### 3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Job-Formed Corners:
  - 1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.
  - 2. Inside Corners: Use straight pieces of maximum lengths possible.

#### 3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet and resilient floor covering that would otherwise be exposed.

#### 3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Perform the following operations immediately after completing resilient product installation:
  - 1. Remove adhesive and other blemishes from exposed surfaces.
  - 2. Sweep and vacuum surfaces thoroughly.
  - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

**END OF SECTION 096513**

## **SECTION 096813 - TILE CARPETING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section includes modular, carpet tile.
- B. Related Requirements:
  - 1. Division 09 Section "Resilient Base and Accessories and Resilient Tile Flooring" for resilient wall base and accessories installed with carpet tile.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
  - 2. Include installation recommendations for each type of substrate.
- B. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
  - 1. Carpet Tile: Full-size Sample.
  - 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch long Samples.
- C. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Warranty: See warranties specified in this Section.

#### **1.5 CLOSEOUT SUBMITTALS**

- A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

#### 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Carpet Tile: Full-size units equal to percentages of amount installed for each carpet type indicated below:
    - a. **All Carpet Tile Types - 10% ATTIC STOCK EACH TYPE.**

#### 1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who employs skilled workers who have experience similar to those required for this Project and whose installations have a record of successful in-service performance.
- B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104.

#### 1.9 FIELD CONDITIONS

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

1.10 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer’s standard form where manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
  2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber, and delamination.
  3. Warranty Period: **10** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

- A. Products: Subject to compliance with requirements, ***provide the products indicated on Drawings and Finish Schedules, or an approved equivalent product:***

**CARPET**

***SEE FINISH FLOOR SCHEDULES/PLANS FOR CARPET TYPES.***

**ENTRY MAT**

***SEE FINISH FLOOR SCHEDULES/PLANS FOR ENTRY MAT TYPES.***

- B. Carpet Tile Color: to be selected by Architect from manufacturer’s full line of standard colors, unless noted otherwise on Schedules.
- C. Performance Characteristics: As follows:
1. Appearance Retention Rating: Heavy traffic, 3.0 minimum according to ASTM D 7330.
  2. Dry Breaking Strength: Not less than 100 lbf according to ASTM D 2646.
  3. Tuft Bind: Not less than 8 lbf according to ASTM D 1335.
  4. Delamination: Not less than 3.5 lbf/in. according to ASTM D 3936.
  5. Dimensional Tolerance: Within 1/32 inch of specified size dimensions, as determined by physical measurement.
  6. Dimensional Stability: 0.2 percent or less according to ISO 2551 (Aachen Test).
  7. Resistance to Insects: Comply with AATCC 24.
  8. Noise Reduction Coefficient (NRC): 60 according to ASTM C 423.
  9. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
  10. Colorfastness to Light: Not less than 4 after 60 AFU (AATCC fading units) according to AATCC 16, Option E.

11. Antimicrobial Activity: Not less than 2-mm halo of inhibition for gram-positive bacteria, not less than 1-mm halo of inhibition for gram-negative bacteria, and no fungal growth, according to AATCC 174.
12. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.

## 2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.
  1. Adhesives shall be equal to: CHAPCO carpet tile adhesive - releasable (50 VOC maximum, solvent-free, non-flammable, freeze-thaw stable, and nearly odor-free). Follow manufacturer's instructions for surface preparation, application and clean up.
  2. Adhesives shall meet EQ Credit 4.1.
- C. Transition Strips: As indicated on Drawings & Finish Schedules, of height required to protect exposed edge of carpet, and of maximum lengths to minimize running joints.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
  1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
  2. Subfloor finishes comply with requirements specified in Division 03 Section "Cast-in-Place Concrete" for slabs receiving carpet tile.
  3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

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

### 3.3 INSTALLATION

- A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: *As noted on Finish Schedules. Confirm with Interior Designer prior to installation.***
- C. Maintain dye lot integrity. Do not mix dye lots in same area.
- D. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- E. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

### 3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
  - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.

2. Remove yarns that protrude from carpet tile surface.
  3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

**END OF SECTION 096813**



## **SECTION 099000 - PAINTING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division Specification sections, apply to this section.

#### **1.2 SUMMARY**

- A. This Section includes surface preparation, painting, and finishing of exposed interior and exterior items and surfaces.
  - 1. Surface preparation, priming, and finish coats specified in this section are in addition to shop priming and surface treatment specified under other sections.
- B. Paint all exposed surfaces whether or not colors are designated in "schedules," except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, the Architect will select from standard colors or finishes available.
- C. Work included in this section:
  - 1. Painting exposed surfaces as indicated.
  - 2. Stain and seal woodwork.
  - 3. Paint exposed woods not scheduled for stain/sealer.
  - 4. Paint all exposed materials not prefinished by factory.
  - 5. Paint equipment-mounting boards.
  - 6. Paint coiling doors primed for field painting.
  - 7. Paint concrete walls where indicated.
- D. Painting is not required on pre-finished items, finished metal surfaces, concealed surfaces, operating parts, and labels.
  - 1. Pre-finished items not to be painted include the following factory-finished components:
    - a. Metal toilet enclosures.
    - b. Acoustic materials, unless indicated otherwise.
    - c. Finished mechanical and electrical equipment, unless indicated otherwise.
    - d. Light fixtures.
    - e. Switchgear, except as indicated.
    - f. Distribution cabinets, except where exposed on walls of occupied spaces.
  - 2. Finished metal surfaces not to be painted include:
    - a. Anodized aluminum.
    - b. Stainless steel.
    - c. Chromium plate.
    - d. Copper.
    - e. Bronze.
    - f. Brass.
  - 3. Operating parts not to be painted include moving parts of operating equipment such as the following:
    - a. Valve and damper operators.
    - b. Linkages.
    - c. Sensing devices.
    - d. Motor and fan shafts.

- 4. Labels: Do not paint over Underwriter's Laboratories, Factory Mutual or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
- E. Accent Colors: Allow for change of colors at chair rails, head rails, and between various groups of rooms and spaces. **Allow for paint colors as specified on the Drawings and Finish Schedule.**
- F. Related Sections: The following sections contain requirements that relate to this section:
  - 1. Division 5 Section "Structural Steel" for shop priming structural steel.
  - 2. Division 5 Section "Metal Fabrications" for shop priming ferrous metal.
  - 3. Division 8 Section "Steel Doors and Frames" for shop priming steel doors and frames.
- G. Shelf Stock: Provide at least one gallon of each color and type of paint, stain, sealer, and coating; labeled as to color and location (mark with "PTX" designation as listed in the Finish Schedule). Do not use shelf stock for punch list work.

### 1.3 SUBMITTALS

- A. Product Data: Manufacturer's technical information, label analysis, and application instructions for each material proposed for use.
  - 1. List each material and cross-reference the specific coating and finish system and application. Identify each material by the manufacturer's catalog number and general classification.
- B. Samples for initial color selection in the form of manufacturer's color charts.
  - 1. After color selection, the Architect will furnish color chips for surfaces to be coated.
    - a. Concrete Masonry: Provide Three (3) 4-by-8-inch samples of masonry, with mortar joint in the center, for each finish and color.
    - b. Painted Wood: Provide Three (3) 12-inch-square samples of each color and material on hardboard.
    - c. Stained or Natural Wood: Provide Three (3) 4-by-8-inch samples of natural and stained wood finish on actual wood surfaces.
    - d. Ferrous Metal: Provide Three (3) 4-inch-square samples of flat metal and two 8-inch-long samples of solid metal for each color and finish.
    - e. Provide paint draw downs in each required finish type (Flat, Satin or Semi-gloss) in which the paint color occurs.
- C. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total systems for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
  - 1. Notify the Architect of problems anticipated using the materials specified.

### 1.4 QUALITY ASSURANCE

- A. Single-Source Responsibility: Provide primers and undercoat paint produced by the same manufacturer as the finish coats.
- B. Coordination of Work: Review other sections in which primers are provided to ensure compatibility of the total systems for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
  - 1. Notify the Architect of problems anticipated using the materials specified.
- C. Material Quality: Provide the manufacturer's best quality trade sale paint material of the various

coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary names used to designate colors or materials are not intended to imply that products named are required or to exclude equal products of other manufacturers.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

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

#### 1.6 JOB CONDITIONS

- A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 deg F (10 deg C) and 90 deg F (32 deg C), unless permitted by paint manufacturer.
- B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 deg F (7 deg C) and 95 deg F (35 deg C), unless permitted by paint manufacturer.
- C. Do not apply paint in snow, rain, fog, or mist, when the relative humidity exceeds 85 percent, at temperatures less than 5 deg F (3 deg C) above the dew point, or to damp or wet surfaces.
  1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the manufacturer during application and drying periods.

#### 1.7 SAMPLE PANELS

- A. Provide for sample panels of each interior accent color, at least 4' x 4' on the assigned wall for that color.
- B. Provide for sample coating on block (provide minimum 3 block) for any specified.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

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

1. The Glidden Company (Glidden) (now I.C.U. Dulux).
2. Benjamin Moore and Co. (Moore).
3. PPG Industries, Pittsburgh Paints (PPG).
4. Pratt and Lambert (P & L).
5. Sherwin-Williams (SW).

## 2.2 PAINT MATERIALS, GENERAL

- A. See paint schedule at the end of this section.
- B. Material Compatibility: Provide block fillers, primers, finish coat materials, and related materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by the manufacturer based on testing and field experience.
- C. Material Quality: Provide the manufacturer's best-quality trade sale paint material of the various coating types specified. Paint material containers not displaying manufacturer's product identification will not be acceptable.
- D. Colors: Colors to be selected by Architect from paint manufacturer's full range of standard colors or as indicated on Drawings and Finish Schedules.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

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

### 3.2 PREPARATION

- A. General Procedures: Remove or properly mask hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items in place that are not to be painted, or provide surface-applied protection prior to surface preparation and painting. Remove these items if necessary for complete painting of the items and adjacent surfaces. Following completion of painting operations in each space or area, have items reinstalled by workers skilled in the trades involved.
  1. Clean surfaces before applying paint or surface treatments. Remove oil and grease prior to cleaning. Schedule cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- B. Surface Preparation: Clean and prepare surfaces to be painted in accordance with the manufacturer's instructions for each particular substrate condition and as specified.
  1. Provide barrier coats over incompatible primers or remove and reprime. Notify Architect in writing of problems anticipated with using the specified finish-coat material with substrates primed by others.
  2. Cementitious Materials: Prepare concrete masonry block, precast walls, and ceilings and other surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve

curing, use mechanical methods of surface preparation.

- a. Use abrasive blast-cleaning or acid etching methods if recommended by the paint manufacturer.
  - b. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer before application of primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
  - c. Prime, stain, or seal wood to be painted immediately upon delivery. Prime edges, ends, faces, undersides, and backsides of wood, including cabinets, counters, cases, and paneling.
  - d. When transparent finish is required, backprime with spar varnish.
  - e. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on backside.
  - f. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately upon delivery.
3. Ferrous Metals: Clean nongalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with recommendations of the Steel Structures Painting Council.
- a. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by the paint manufacturer, and touch up with the same primer as the shop coat.
4. Galvanized Surfaces: Clean galvanized surfaces with non- petroleum-based solvents so that the surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- C. Materials Preparation: Carefully mix and prepare paint materials in accordance with manufacturer's directions.
1. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.
  2. Stir material before application to produce a mixture of uniform density; stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.
  3. Use only thinners approved by the paint manufacturer, and only within recommended limits.
- D. Tinting: Tint each undercoat a lighter shade to facilitate identification of each coat where multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

### 3.3 APPLICATION

- A. Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.
- B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
  1. Paint colors, surface treatments, and finishes are indicated in "schedules."
  2. Provide finish coats that are compatible with primers used.
  3. The number of coats and film thickness required is the same regardless of the application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. Sand between applications where sanding is required to produce an even smooth surface in accordance with the manufacturer's directions.
  4. Apply additional coats when undercoats, stains, or other conditions show through final coat of paint until paint film is of uniform finish, color, and appearance. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive a dry film thickness equivalent to that of flat surfaces.

5. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convactor covers, covers for finned tube radiation, grilles, and similar components are in place. Extend coatings in these areas as required to maintain the system integrity and provide desired protection.
  6. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces.
  7. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, nonspecular black paint.
  8. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
  9. Finish interior of wall and base cabinets and similar field- finished casework to match exterior.
  10. Finish exterior doors on tops, bottoms, and side edges same as exterior faces.
  11. Sand lightly between each succeeding enamel or varnish coat.
  12. Omit primer on metal surfaces that have been shop-primed and touch up painted.
- C. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
1. Allow sufficient time between successive coats to permit proper drying. Do not recoat until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure and where application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.
- D. Minimum Coating Thickness: Apply materials at not less than the manufacturer's recommended spreading rate. Provide a total dry film thickness of the entire system as recommended by the manufacturer.
- E. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
- F. Prime Coats: Before application of finish coats, apply a prime coat of material as recommended by the manufacturer to material that is required to be painted or finished.
- G. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling such as laps, irregularity in texture, skid marks, or other surface imperfections.
- H. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- I. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, cloudiness, color irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections.
1. Provide satin finish for final coats on wood casework, trim or any other exposed surfaces unless noted otherwise.
- J. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not in compliance with specified requirements.

### 3.4 CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

### 3.5 PROTECTION

- A. Protect work of other trades, whether to be painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.
- B. Provide "wet paint" signs to protect newly painted finishes. Remove temporary protective

wrappings provided by others for protection of their work after completion of painting operations.

1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

### 3.6 EXTERIOR PAINT SCHEDULE

- A. General: Provide the following paint systems or manufacturer’s equivalent per noted color selections for the various substrates indicated.
  1. It is the contractors responsibility to submit matching color samples of specified colors by other manufacturers if used. Architect or Interior Designer will verify color match from submittals by other manufacturer’s.
- B. Ferrous Metal: Primer is not required on shop-primed items.
  1. Full-Gloss Alkyd Enamel: 2 finish coats over primer.
    - a. Primer: Synthetic Rust-Inhibiting Primer: Benjamin Moore MO7 Universal Primer or equivalent.
    - b. First Coat: Benjamin Moore, CM22 Urethane Alkyd or Alkyd Gloss Enamel (ICI-4308 or Sherwin Williams B54 Series).
    - c. Second Coat: Benjamin Moore, CM22 Urethane Alkyd or Alkyd Gloss Enamel (ICI- 4308 or Sherwin Williams B54 Series).
- C. Zinc-Coated Metal:
  1. High-Gloss Alkyd Enamel: 2 finish coats over primer: Benjamin Moore MO7 Universal Primer or equivalent.
    - a. Primer: Galvanized Metal Primer or Benjamin Moore MO7 Universal Primer .
    - b. First Coat: Benjamin Moore, CM22 Urethane Alkyd or Alkyd Gloss Enamel (ICI-4308 or Sherwin Williams B54 Series).
    - c. Second Coat: Benjamin Moore, CM22 Urethane Alkyd or Alkyd Gloss Enamel (ICI-4308 or Sherwin Williams B54 Series).
- D. Concrete / Tilt-Up Concrete / Existing Exterior CMU Walls:
  1. Primer: Moore high build acrylic masonry primer 068 (Sherwin Williams A24W300).
  2. Finish Coat: Moore Moorlastic acrylic elastomeric – **heavy sand texture** 060 (20 mil thickness minimum WFT) (Sherwin Williams A5-800 Series).
- E. Existing exterior E.I.F.S. system:
  1. Clean and/or powerwash existing surface as recommended by the paint manufacturer.
  2. Finish Coat(s): Two (2) coats Sherwin Williams ConFlex XL smooth elastomeric high build coating or Benjamin Moore Moorlastic 100% acrylic elastomeric waterproof coating – low luster finish (20 mil thickness minimum WFT), or equivalent. If substitutions are requested, it is the responsibility of the Contractor to prove equivalency of product.

### 3.7 INTERIOR PAINT SCHEDULE

- A. General: Provide the following paint systems or manufacturer’s equivalent per noted color selections for the various substrates, as indicated.
  1. It is the contractors responsibility to submit matching color samples of specified colors by other manufacturers if used. Architect or Interior Designer will verify color match from submittals by other manufacturer’s.

B. Concrete Masonry Units:

1. Undercoat: Sherwin Williams PrepRite 200 Interior Latex Primer or Benjamin Moore Ultra Spec 500 Interior Primer
2. Two coats: Sherwin Williams, Pro Industrial Pre-Catalyzed waterbased Epoxy, Eg-Shel, or Benjamin Moore Corotech Pre-Catalyzed Waterborne Epoxy, Eggshell.

C. Drywall:

1. Primer: Primer: Sherwin Williams, Multi-Purpose Primer or Benjamin Moore Ultra Spec 500 Interior Primer
2. Two Coats: Sherwin Williams Cashmere Acrylic Latex Eg-Shel or Benjamin Moore, Ben Interior Acrylic Latex, Eggshell.

D. Drywall: High Durability/High Performance. Provide high durability paint at all restrooms, mechanical rooms, janitor’s closets, and showers.

1. Undercoat: Sherwin Williams PrepRite 200 Interior Latex Primer or Benjamin Moore Ultra Spec 500 Interior Primer
2. Two coats: Sherwin Williams, Pro Industrial Pre-Catalyzed waterbased Epoxy, Eg-Shel, or Benjamin Moore Corotech Pre-Catalyzed Waterborne Epoxy, Eggshell.

E. Drywall: Scuff Resistant Paint for accent walls, see finish schedule for.

1. Undercoat: Sherwin Williams PrepRite 200 Interior Latex Primer or Benjamin Moore Ultra Spec 500 Interior Primer
2. Two coats: Sherwin Williams Scuff Tuff, Eg-Shel or Benjamin Moore Scuff-X Interior Latex, Eggshell

F. Painted Woodwork and Hardboard:

1. Undercoat: Sherwin Williams Premium Wall and Wood Primer or Benjamin Moore 023 Fresh Start Acrylic Primer
2. Two coats: Benjamin Moore M29 DTM Acrylic Semi-Gloss or Sherwin Williams, Pro Industrial Waterbased Alkyd Urethane, Semi-Gloss

G. Ferrous Metal:

1. Primer: Benjamin Moore Ultra Spec HP Acrylic Primer or Sherwin Williams Pro Industrial Pro-Cryl Universal Primer or equal.
2. Two coats over primer: Benjamin Moore Ultra Spec DTM Acrylic Enamel Semi-Gloss or Sherwin Williams Pro Industrial DTM Acrylic Semi-Gloss.

H. Zinc-Coated Metal:

1. Primer: Benjamin Moore Ultra Spec HP Acrylic Metal Primer or Sherwin Williams Pro Industrial Pro-Cryl Universal Primer.
2. Two coats over primer: Benjamin Moore Ultra Spec HP DTM Acrylic Semi-Gloss or Sherwin Williams Pro Industrial DTM Acrylic Semi-Gloss.

**END OF SECTION 099000**



## **SECTION 101400 - SIGNAGE**

### **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. Work included in this section: Provision and installation of interior signage. Provide miscellaneous specialties, complete, including mounting, accessories, and anchors as required to completely install signage indicated on Drawings and included herein.
- B. This Section includes the following:
  - 1. Interior Mens, Womens & Unisex “Restroom” Signage
  - 2. Interior “Exit” Signage
  - 3. Miscellaneous Signage

#### **1.3 DEFINITIONS**

- A. ADA-ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines."

#### **1.4 SUBMITTALS**

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for signs.
  - 1. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
  - 2. Provide message list, typestyles, graphic elements, including tactile characters and Braille, and layout for each sign.
  - 3. Submit shop drawings indicating location, details of installation, finishes, and other pertinent data.
- C. Samples for Initial Selection/Verification: Manufacturer's color charts consisting of actual units or sections of units showing the full range of colors available for the following:
  - 1. Aluminum / Stainless Steel.
  - 2. Acrylic / Polycarbonate sheet.

3. Die-cut vinyl characters and graphic symbols. Include representative samples of available typestyles and graphic symbols.

- D. Qualification Data: For Installer.
- E. Warranty: See warranty specified in this Section 1.8.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- C. Source Limitations for Signs: Obtain each sign type indicated from one source from a single manufacturer.
- D. Regulatory Requirements: Comply with applicable provisions in ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
- E. Store delivered in a clean, safe, dry area until needed.

#### 1.6 PROJECT CONDITIONS

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

#### 1.7 COORDINATION

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

#### 1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
  1. Failures include, but are not limited to, the following:
    - a. Deterioration of metal and polymer finishes beyond normal weathering.
    - b. Deterioration of embedded graphic image colors and sign lamination].
  2. Warranty Period: Five (5) years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PLAQUE SIGNS

- A. Basis-of-Design Product: ***Subject to compliance with requirements, provide the product indicated on Drawings and Equipment Schedules*** or a equivalent product by one of the following:
1. ACE Sign Systems, Inc.
  2. Advance Corporation; Braille-Tac Division.
  3. Allen Industries Architectural Signage
  4. Allenite Signs; Allen Marking Products, Inc.
  5. APCO Graphics, Inc.
  6. ASI-Modulex, Inc.
  7. Best Sign Systems Inc.
  8. Bunting Graphics, Inc.
  9. Fossil Industries, Inc.
  10. Gemini Incorporated.
  11. Grimco, Inc.
  12. Innerface Sign Systems, Inc.
  13. InPro Corporation
  14. Matthews International Corporation; Bronze Division.
  15. Mills Manufacturing Company.
  16. Mohawk Sign Systems.
  17. Nelson-Harkins Industries.
  18. Seton Identification Products.
  19. Signature Signs, Incorporated.
  20. Supersine Company (The)
  21. Rockwood
  22. Pinnacle Sign Group
  23. Other local sign fabricators capable of producing product indicated.
- B. Interior Plaque Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner, complying with the following requirements:
1. All sign materials based on product indicated on Equipment schedule shall be equal to comparable product.
  2. Finish all exposed edges to match sign face per product specified.
  3. Mounting: mount to wall with concealed mounting method – see Execution.
    - a. Wall mounted with concealed anchors or two-face tape.
    - b. Manufacturer's standard anchors for substrates encountered.
  4. Tactile Characters: Characters and Grade 2 Braille raised 1/32 inch above surface with contrasting colors.
- C. Tactile and Braille Sign: Manufacturer's standard process for producing text and symbols complying with ADA-ABA Accessibility Guidelines and with ICC/ANSI A117.1. Text shall be

accompanied by Grade 2 Braille. Produce precisely formed characters with square-cut edges free from burrs and cut marks; Braille dots with domed or rounded shape.

D. Sign Schedule:

1. ***See Signage Details as indicated on Drawings, Equipment Schedules, and Floor Plans.***

- a. Sign Size, Material, Finish/Color, Characters, and Text: As indicated on Drawings and Equipment Schedule.
- b. Location: As indicated on Drawings.
- c. Room: As indicated on Drawings. All new rooms in Project Extents to have signage.
- d. Quantity: As indicated on Drawings.

2.2 FABRICATION

A. General: Provide manufacturer's standard signs of configurations indicated.

1. Mill joints to tight, hairline fit. Form joints exposed to weather to exclude water penetration.
2. Preassemble signs in the shop to greatest extent possible. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in location not exposed to view after final assembly.
3. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.

2.3 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

- B. Verify that items, including anchor inserts, are sized and located to accommodate signs.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Verification of Conditions: Verify area to receive signage. Signage is free of impediments interfering with installation and condition of installation substrates are acceptable to receive signage in accordance with sign manufacturer’s recommendations. Do not commence until conditions are satisfactory.
- E. Field Verify dimensions and layout prior to shop drawing submittal and fabrication of signs.
- F. Coordination details with other work supporting, adjoining, or otherwise contracting items as required to insure proper installation.
- G. Examine construction to verify that:
  - a. Dimensions are correct to manufacturer’s specifications.
- H. Do not install items until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.
  - 1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
  - 2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.
- B. Wall-Mounted Signs: Comply with sign manufacturer's written instructions except where more stringent requirements apply.
  - 1. Two-Face Tape: Mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.
  - 2. Hook-and-Loop Tapes: Mount signs to smooth, nonporous surfaces.
  - 3. Magnetic Tape: Mount signs to smooth, nonporous surfaces.
  - 4. Silicone-Adhesive Mounting: Attach signs to irregular, porous, or vinyl-covered surfaces.
  - 5. Shim Plate Mounting: Provide 1/8-inch thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other mounting methods are not practicable. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach panel signs to plate using method specified above.
  - 6. Mechanical Fasteners: Use nonremovable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.

7. Signs Mounted on Glass: Provide matching opaque plate on opposite side of glass to conceal mounting materials.

### 3.3 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.
- B. Clean work area and remove debris from project site.
- C. General: Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer to ensure signage are without damage or deterioration at time of substantial completion.

**END OF SECTION 101400**

## **SECTION 102217 – POWDER COATED STEEL TOILET PARTITIONS**

### **PART 1 - GENERAL**

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

- A. The toilet partitions shall be powder coated steel with floor anchored/overhead braced mounting style as manufactured by ASI Accurate Partitions, Burr Ridge, Illinois, or pre-approved equivalent.
- B. Furnish all labor and materials necessary for completion of work in this section as shown in the approved drawings and specified herein.

#### **1.2 SUBMITTALS**

- A. Submittals for Review:
  - 1. Shop Drawings: Include dimensioned layout, elevations, trim, closures, and accessories.
  - 2. Product Data: Manufacturer's descriptive data for panels, hardware, and accessories.
  - 3. Samples: 2 x 3 inch samples showing available colors, or as specified on Finish Schedules and Finish Notes on Drawings.

#### **1.3 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Minimum five (5) years of experience in manufacture of solid plastic toilet compartments with products in satisfactory use under similar service conditions.
- B. Installer Qualifications: Minimum five (5) years of experience in work of this Section

### **PART 2 - PRODUCT**

#### **2.1 DOOR, PANELS, PILASTER AND URINAL SCREENS**

- A. Doors, panels and urinal screens shall be 1" thick and fabricated from tension-leveled, cold rolled commercial quality 22 gauge galvanized steel, bonded to sound deadening honeycomb core.
- B. Pilasters shall be 1-1/4 " thick, 82" high, and fabricated from tension-leveled, cold rolled commercial quality 22 gauge galvanized steel, bonded to sound deadening honeycomb core.

#### **2.2 MATERIAL**

- A. Doors, panels, pilasters and urinal screens shall be manufactured with a honeycomb core bonded to the steel with a non-toxic adhesive to ensure solid construction and sound attenuation. All four components shall be assembled with a continuous roll-formed interlocking crown molding, with the corners brazed and ground smooth.

## 2.3 FINISH

- A. Doors, panels, pilasters, and urinal screens shall be cleaned for maximum finish color adhesion. All components shall be finished with a hybrid epoxy/polyester powder, electrostatically applied to ensure uniform thickness and baked to cure.

## 2.3 COLOR:

- A. Will be selected from Accurate’s full range of manufacturer’s designer colors/textures/finishes. See Finish Schedule for color selection. Color/type to be selected from a full line of manufacturer’s colors and finishes. ***Design intent: Accurate Partitions, Silver Metallic 971. See Finish Floor Plans & Schedules***

## 2.4 DOOR HARDWARE

- A. Shall be Accurate gravity actuated, cam-action hinges that permit door to remain at desired position when not in use. Hinges, one-piece strike and keeper and coat hook shall be manufacturer’s optional stainless steel to resist corrosion. Hinges, strike and keeper shall be attached with tamper resistant stainless steel barrel nuts and shoulder screws. Concealed latch assembly shall allow for emergency access. Doors for handicapped compartments shall be supplied with Accurate stainless steel ADA paddle handles.
- B. All aluminum finishes shall be a heavy-duty extruded aluminum alloy with a bright dip anodized finish. All stainless steel finishes shall be manufacturer’s standard brushed finish. No Zamac or chrome finished steel materials are permitted.

## 2.5 MOUNTING HARDWARE

- A. Provide manufacturer’s optional continuous aluminum brackets to mount panels and pilasters. Mounting hardware shall be secured with manufacturer approved tamper resistant screws.

## 2.6 CONSTRUCTION DESIGN

- A. Compartments shall be floor anchored with L-shaped mounting forks and include integral leveling bolt to provide proper height adjustment. Floor anchoring system shall be concealed with a type 304 stainless steel trim shoe with a #4 finish. Aluminum headrail with anti-grip profile shall provide overhead bracing and span all compartments and brace the end pilaster to the back wall.
- B. No Zamac or chrome finished steel materials are permitted.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Shall be installed in accordance to the ASI Accurate’s installation instructions with partitions



- rigid, straight and plumb. Doors and panels shall be mounted 12” above the finished floor.
- B. Not Acceptable: Evidence of cutting, drilling, or patching.

### 3.2 WARRANTY

- A. ASI Accurate Partitions guarantees its powder coated steel partitions, properly maintained, against chipping, flaking, cracking or discoloration for 3 YEARS from the date of Substantial Completion. If material is found defective during that period, the material shall be replaced free of charge. No credits or allowances shall be issued for any labor or expenses relating to the replacement of components covered under the warranty plan.
- B. Adjust doors and latches to operate correctly.
- C. Clean exposed surfaces of partition systems using materials and methods recommended by manufacturer, and provide protection as necessary to prevent damage during remainder of construction period.

**END OF SECTION 102216**

## **SECTION 102800 – TOILET ACCESSORIES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Restroom accessories.
- B. Related Sections include the following:
  - 1. Division 08 Section "Mirrors" for frameless mirrors.

#### **1.3 SUBMITTALS**

- A. Product Data: For each type of product indicated. Include the following:
  - 1. Construction details and dimensions.
  - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
  - 3. Material and finish descriptions.
  - 4. Features that will be included for Project.
  - 5. Manufacturer's warranty.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
  - 1. Identify locations using room designations indicated on Drawings.
  - 2. Identify products using designations indicated on Drawings.
- C. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

#### **1.4 QUALITY ASSURANCE**

- A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.

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

#### 1.5 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

#### 1.6 WARRANTY

- 1. Submit manufacturer's standard warranty for products specified.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch minimum nominal thickness, unless otherwise indicated.
- B. Brass: ASTM B 19 flat products; ASTM B 16, rods, shapes, forgings, and flat products with finished edges; or ASTM B 30, castings.
- C. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.0359-inch minimum nominal thickness.
- D. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 hot-dip zinc coating.
- E. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- F. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- G. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- H. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- I. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

## 2.2 RESTROOM ACCESSORIES

- A. Basis-of-Design Product: ***The design for accessories is based on products indicated on Drawings & Equipment Schedules.*** Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
1. A & J Washroom Accessories, Inc.
  2. American Specialties, Inc.
  3. Bobrick Washroom Equipment, Inc.
  4. Bradley Corporation.
  5. General Accessory Manufacturing Co. (GAMCO).
- B. Toilet Tissue (Roll) Dispenser(s):
1. Basis-of-Design Product/Material/Finish: ***See Equipment Schedule on Drawings.***
  2. Mounting: Install per manufacturer’s written instructions.
- C. Paper Towel (Folded) Dispenser(s):
1. Basis-of-Design Product/Material/Finish: ***See Equipment Schedule on Drawings.***
  2. Mounting: Install per manufacturer’s written instructions.
- D. Waste Receptacle(s):
1. Basis-of-Design Product/Material/Finish: ***See Equipment Schedule on Drawings.***
  2. Mounting: Install per manufacturer’s written instructions.
- E. Liquid-Soap Dispenser(s):
1. Basis-of-Design Product/Material/Finish: ***See Equipment Schedule on Drawings.***
  2. Mounting: Install per manufacturer’s written instructions.
- F. Grab Bars:
1. Basis-of-Design Product/Material/Finish: ***See Equipment Schedule on Drawings.***
  2. Mounting: Install per manufacturer’s written instructions. Flanges with concealed fasteners.
- G. Sanitary-Napkin Disposal Unit(s):
1. Basis-of-Design Product/Material/Finish: ***See Equipment Schedule on Drawings.***
  2. Mounting: Install per manufacturer’s written instructions.
- H. Mirror Unit(s):
1. Basis-of-Design Product/Material/Finish: ***See Equipment Schedule on Drawings.***
  2. Mounting: Install per manufacturer’s written instructions.
  3. Size: As indicated on Drawings

I. Other:

1. See Equipment Schedules on Drawings for other misc. accessories not indicated herein.
2. Mounting: Install per manufacturer's written instructions.

2.3 CUSTODIAL ACCESSORIES

A. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. A & J Washroom Accessories, Inc.
2. American Specialties, Inc.
3. Bobrick Washroom Equipment, Inc.
4. Bradley Corporation.
5. General Accessory Manufacturing Co. (GAMCO).

B. Mop and Broom Holder:

1. Basis-of-Design Product: Bobrick B-223x24 or equivalent.
2. Description: Unit with hooks/holders.
3. Length: 24 inches.
4. Hooks: Three.
5. Location: All Janitor Closets where mop sinks are located.
6. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.
7. Material and Finish: Stainless steel, No. 4 finish (satin).
  - a. Shelf: Not less than nominal 0.05-inch thick stainless steel.
  - b. Rod: Approximately 1/4-inch diameter stainless steel.

2.4 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and re-supplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.

### 3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

**END OF SECTION 102800**

## SECTION 104413 - FIRE EXTINGUISHER CABINETS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Fire protection cabinets for the following:
    - a. Portable fire extinguishers.
- B. Related Sections:
  - 1. Division 09 painting Sections for field painting fire protection cabinets.
  - 2. Division 10 Section "Fire Extinguishers."

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.
  - 1. Fire Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
- B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. Product Schedule: For fire protection cabinets. Coordinate final fire protection cabinet schedule with fire extinguisher schedule to ensure proper fit and function. **Use same designations indicated on Drawings.**
- D. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

1.5 COORDINATION

- A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate sizes and locations of fire protection cabinets with wall depths.

1.6 SEQUENCING

- A. Apply decals and/or vinyl lettering specified on field-painted, fire protection cabinets after painting is complete.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
  - 1.
- B. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.2 FIRE PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
  - 1. Products: Subject to compliance with requirements, provide cabinets as indicated on Drawings and Equipment Schedules or an equivalent product from the following available manufacturer’s. Note: not all manufacturer’s listed may provide equivalent products to product specified.
    - a. Fire End & Croker Corporation.
    - b. J. L. Industries, Inc., a division of Activar Construction Products Group.
    - c. Kidde Residential and Commercial Division, Subsidiary of Kidde plc.
    - d. Larsen's Manufacturing Company >.
    - e. Modern Metal Products, Division of Technico Inc..
    - f. Moon-American.
    - g. Potter Roemer LLC.
    - h. Watrous Division, American Specialties, Inc..



- B. Cabinet Construction: Nonrated where indicated on Drawings. Provide 1-hour fire rated cabinets where indicated on rated walls on Drawings.
  - 1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.0428-inch thick, cold-rolled steel sheet lined with minimum 5/8-inch thick, fire-barrier material. Provide factory-drilled mounting holes.
- C. Cabinet Material: Steel sheet.
  - 1. Shelf: Same metal and finish as cabinet.
- D. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.
  - 1. Rolled-Edge Trim: 2-1/2-inch backbend depth.
- E. Cabinet Trim Material: Same material and finish as door.
- F. Door Material: Steel sheet.
- G. Door Style: Vertical duo panel with frame.
- H. Door Glazing: Tempered float glass (clear).
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
  - 1. Provide manufacturer's standard.
  - 2. Provide manufacturer's standard hinge permitting door to open 180 degrees.
- J. Accessories:
  - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
  - 2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
    - a. Identify fire extinguisher in fire protection cabinet with the words "FIRE EXTINGUISHER."
      - 1) Location: Applied to cabinet door or cabinet glazing depending on product.
      - 2) Application Process: Manufacturer's standard.
      - 3) Lettering Color: Red.
      - 4) Orientation: Vertical.
- K. Finishes:

1. Steel: Baked Enamel Finish – Color selected by Architect from full line of manufacturer's standard colors.

## 2.3 FABRICATION

- A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
  1. Weld joints and grind smooth.
  2. Provide factory-drilled mounting holes.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
  1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
  2. Fabricate door frames of one-piece construction with edges flanged.
  3. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

## 2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

## 2.5 STEEL FINISHES

- A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning" or SSPC-SP 8, "Pickling." After cleaning, apply a conversion coating suited to the organic coating to be applied over it.
- B. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.

1. Color and Gloss: **As selected by Architect from manufacturer's full range.**

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine roughing-in for cabinets before cabinet installation.
- B. Examine walls and partitions for suitable framing depth and blocking where semirecessed cabinets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Prepare recesses for semirecessed fire protection cabinets as required by type and size of cabinet and trim style.

#### 3.3 INSTALLATION

- A. General: Install fire protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights indicated below or, at heights acceptable to authorities having jurisdiction.
  1. Fire Protection Cabinets: 54 inches above finished floor to top of cabinet.
- B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.
  1. Unless otherwise indicated, provide recessed fire protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semirecessed fire protection cabinets.
  2. Provide inside latch.
  3. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.
  4. Fire-Rated, Cabinets:
    - a. Install cabinet with not more than 1/16-inch tolerance between pipe OD and knockout OD. Center pipe within knockout.
    - b. Seal through penetrations with firestopping sealant as specified in Division 07 Section "Penetration Firestopping."
- C. Identification: Apply decals and/or vinyl lettering at locations indicated.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire protection cabinet doors to operate easily without binding.
- C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.
- E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

**END OF SECTION 104413**

## SECTION 104416 - FIRE EXTINGUISHERS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes portable, fire extinguishers and mounting brackets for fire extinguishers.
- B. Related Sections:
  - 1. Division 10 Section "Fire Extinguisher Cabinets."

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Product Schedule: For fire extinguishers. Coordinate final fire extinguisher schedule with fire protection cabinet schedule to ensure proper fit and function. **Use same designations indicated on Drawings and Equipment Schedules.**
- C. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.
- D. Warranty: Sample of special warranty.

#### 1.4 QUALITY ASSURANCE

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
  - 1. Provide fire extinguishers approved, listed, and labeled by FMG.

1.5 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire protection cabinets to ensure fit and function.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Failure of hydrostatic test according to NFPA 10.
    - b. Faulty operation of valves or release levers.
  - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Type, size, and capacity for each fire protection cabinet and mounting bracket indicated.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings/Equipment Schedule or equivalent product by one of the following:
    - a. Amerex Corporation.
    - b. Ansul Incorporated; Tyco International Ltd.
    - c. Badger Fire Protection; a Kidde company.
    - d. Buckeye Fire Equipment Company.
    - e. Fire End & Croker Corporation.
    - f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
    - g. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
    - h. Larsen's Manufacturing Company.
    - i. Moon-American.
    - j. Pem All Fire Extinguisher Corp.; a division of PEM Systems, Inc.
    - k. Potter Roemer LLC.
    - l. Pyro-Chem; Tyco Safety Products.
  - 2. Valves: Manufacturer's standard.
  - 3. Handles and Levers: Manufacturer's standard.
  - 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

- B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container. UL-rated for Class A, B & C fires.

## 2.2 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red or black baked-enamel finish.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings/Equipment Schedule or equivalent product by one of the following:
    - a. Amerex Corporation.
    - b. Ansul Incorporated; Tyco International Ltd.
    - c. Badger Fire Protection; a Kidde company.
    - d. Buckeye Fire Equipment Company.
    - e. Fire End & Croker Corporation.
    - f. J. L. Industries, Inc.; a division of Activar Construction Products Group.
    - g. Larsen's Manufacturing Company.
    - h. Potter Roemer LLC.
  - B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
    - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
      - a. Orientation: Vertical.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
  - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. Inspect substrate and conditions under which brackets are to be installed. Remedy any conditions detrimental to this installation before proceeding.

3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
  - 1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.
  - 2. Install per manufacturer's written instructions.
  - 3. Provide all required hardware anchoring devices and accessories for a complete finished installation in type of wall shown on Drawings. Provide any additional blocking as required.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

**END OF SECTION 104416**



## SECTION 211313– FIRE SUPPRESSION SYSTEM

### 1.1 RELATED DOCUMENTS

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

### 1.2 SYSTEM DESCRIPTION

Existing system is in place in existing building, project is modifying system to accommodate new addition and accommodate any revisions required

#### A. Performance Criteria:

1. The Fire Protection Subcontractor is responsible for code compliance, research, design, coordination, and installation of a complete and functional hydraulically calculated sprinkler system that meets the approval of and is in accordance with all applicable regulations and requirements of the following and as further specified:
  - a. Current editions of NFPA pamphlet Nos. 13, 14, 20, 25 and 96.
  - b. Factory Mutual 2-8N.
  - c. Applicable Codes.
  - d. Authorities having jurisdiction.
  - e. All u/g piping shall be in accordance with NFPA 24, PVC piping shall be AWWA C900 or better.
2. Alarm system devices including alarm valves, flow switches, tamper switches, and coordination with Fire Alarm and Detection Subcontractor.
3. Access panels for service and access to valves in enclosed ceiling and walls.

- 1.3 Be responsible for obtaining all permits and approvals of the fire protection system. All installations of fire related equipment and materials must have a current passing inspection with a green tag prior to occupancy.

### SUBMITTALS

#### A. Performance Criteria:

1. Shop Drawings and calculations sealed by a registered Professional Engineer, NICET III or IV Sprinkler Designer, licensed in Missouri.
2. Be responsible for code research and obtaining all required flow test data and hydraulically designing a fire protection system that meets all applicable requirements. Arrange for and conduct the flow test and coordinate its validity with Factory Mutual.
3. Fire protection submittal data shall include the following:
  - a. Existing Flow Test Data
  - b. Appropriate hydraulic calculations
  - c. Complete stamped and coordinated shop drawings
  - d. Pipes and fittings
  - e. Valves
  - f. Sprinkler heads
  - g. Escutcheons

- h. All applicable devices, alarms, and specialties
  - i. Applicable control/wiring diagrams.
- 4. Transmit fire protection submittal data to local Factory Mutual office, the local and state authorities having jurisdiction, and to licensing agencies for approval.
- 5. Do not proceed with work without final approved submittal data bearing all approval stamps.
- 6. Zoning: At a minimum, the system shall be zoned by floor or as required to meet the approval of all applicable Codes and Authorities, whichever is most stringent.
- 7. Inspectors test connections: Locate at the remote end of each zone with discharge pipe to exterior.
- 8. Connect sprinkler piping to riser at each zone. Provide control valve, flow and tamper switches at each connection monitored on the fire alarm system. Locate inspector’s test assembly at remote end of zone with discharge piped to exterior drain.
- 9. Design densities (based on Factory Mutual requirements):
  - a. Public Spaces: Wet pipe system with 0.10 gpm per square foot over the most remote 1,500 square feet plus 250 gpm for hose.
  - b. Mechanical Rooms, Storage, and Service Areas: Wet pipe system with 0.15 gpm per square foot over 2,500 square feet plus 250 gpm for hose.

#### 1.4 COORDINATION

##### A. Performance Criteria:

- 1. The Fire Protection Subcontractor shall be responsible for reviewing the complete set of Contract Documents and coordinating his work with all other trades involved including building design loads.
- 2. Sprinkler head locations shall be coordinated with the Architectural Reflected Ceiling Plans and Fire Protection sheets. If the Contractor finds that additional sprinklers are required to meet Codes or Factory Mutual requirements, he shall proceed with the additional heads at no additional cost to the Owner.
- 3. The fire protection piping and head layout shall function in such a manner so as not to interfere with lighting fixtures, air distribution devices, equipment, piping, beams, and ductwork. The work under this section shall yield to all other trades.
- 4. Coordinate with Smoke shut down on the HVAC equipment.
- 5. Provide the building with a complete, approved, operational sprinkler system in all areas.
- 6. Provide wet-pipe sprinklers for habitable spaces such as shelter, corridors, and public areas.
- 7. Design documents are for information only. The sprinkler subcontractor shall be responsible for the actual layouts, routing of piping, and additional sprinkler heads to meet all requirements of the authority having jurisdiction.
- 8. Be responsible for freeze protection as follows:
  - a. Wet piping shall not be routed through unheated areas, such as attics, etc.

- b. Be responsible for repair and/or all costs incurred from damage caused by freezing of the fire protection system.

9. insure a Fire Department Siamese connection, provide Knox lockable caps.

#### 1.5 PIPE AND FITTINGS

##### A. Performance Criteria:

1. Piping – Class I, Schedule 40 ASTM black steel piping for branches and Class I Schedule 10 ASTM black steel for mains.

#### 1.6 SPRINKLERS

##### A. Performance Criteria:

1. Sprinkler heads shall be UL listed and Factory Mutual approved.
2. Sprinkler heads' temperature rating and response time to be determined by fire suppression designer.

#### 1.8 INSTALLATION

##### A. Performance Criteria

1. Locate wet pipe inspector test valves and associated sight glasses at remote ends of system, in accessible locations. Provide drainpipes to exterior. Do not discharge onto sidewalks or landscaping.
2. Under no circumstances shall wet sprinkler pipes be routed through attics or other unheated spaces.

#### 1.9 CLEANING/TESTING

##### A. Performance Criteria:

1. Testing of the completed fire protection systems shall be witnessed by City of Springfield fire dept. Representative.
2. Provide the building manager engineer with record drawings and equipment data at completion of the construction.
3. Provide all equipment necessary to perform tests.

**END OF SECTION 21100**

## SECTION 220523 - VALVES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following general-duty valves:
  - 1. Copper-alloy ball valves.
  - 2. Ferrous-alloy ball valves.
  - 3. Ferrous-alloy butterfly valves.
  - 4. Bronze check valves.
  - 5. Ferrous-alloy wafer check valves.
  - 6. Spring-loaded, lift-disc check valves.
  - 7. Bronze gate valves.
  - 8. Cast-iron gate valves.
  - 9. Bronze globe valves.
  - 10. Cast-iron plug valves.
- B. Related Sections include the following:
  - 1. Division 21131 fire-suppression piping and fire pump sections for fire-protection valves.
  - 2. Division 220553 Section "Mechanical Identification" for valve tags and charts.

#### 1.3 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.

#### 1.4 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; shipping, installed, and operating weights; furnished specialties; and accessories.

#### 1.5 QUALITY ASSURANCE

- A. ASME Compliance: ASME B31.9 for building services piping valves.
  - 1. Exceptions: Domestic hot- and cold-water piping valves unless referenced.
- B. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.
4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

- B. Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. 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.

### 2.2 VALVES, GENERAL

- A. Refer to Part 3 "Valve Applications" Article for applications of valves.
- B. Bronze Valves: NPS 2 and smaller with threaded ends, unless otherwise indicated.
- C. Ferrous Valves: NPS 2-1/2 and larger with flanged ends, unless otherwise indicated.
- D. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- E. Valve Sizes: Same as upstream pipe, unless otherwise indicated.
- F. Valve Actuators:
  1. Handwheel: For valves other than quarter-turn types.
  2. Lever Handle: For quarter-turn valves NPS 6 and smaller, except plug valves.
  3. Wrench: For plug valves with square heads. Furnish Owner with 1 wrench for every 10 plug valves, for each size square plug head.
- G. Extended Valve Stems: On insulated valves.
- H. Valve Flanges: ASME B16.1 for cast-iron valves, ASME B16.5 for steel valves, and ASME B16.24 for bronze valves.

- I. Valve Grooved Ends: AWWA C606.
  - 1. Solder Joint: With sockets according to ASME B16.18.
    - a. Caution: Use solder with melting point below 840 deg F for angle, check, gate, and globe valves; below 421 deg F for ball valves.
  - 2. Threaded: With threads according to ASME B1.20.1.
- J. Valve Bypass and Drain Connections: MSS SP-45.

## 2.3 COPPER-ALLOY BALL VALVES

- A. Available Manufacturers:
  - 1. One-Piece, Copper-Alloy Ball Valves:
    - a. Conbraco Industries, Inc.; Apollo Div.
    - b. Crane Co.; Crane Valve Group; Jenkins Valves.
    - c. Crane Co.; Crane Valve Group; Stockham Div.
    - d. Grinnell Corporation.
    - e. NIBCO INC.
    - f. Watts Industries, Inc.; Water Products Div.
- B. Copper-Alloy Ball Valves, General: MSS SP-110.
- C. One-Piece, Copper-Alloy Ball Valves: Brass or bronze body with chrome-plated bronze ball, PTFE or TFE seats, and 400-psig CWP rating.

## 2.4 FERROUS-ALLOY BALL VALVES

- A. Manufacturers:
  - 1. Conbraco Industries, Inc.; Apollo Div.
  - 2. Crane Co.; Crane Valve Group; Stockham Div.
  - 3. Hammond Valve.
  - 4. Jomar International, LTD.
  - 5. Milwaukee Valve Company.
  - 6. NIBCO INC.
  - 7. PBM, Inc.
  - 8. Worcester Controls.
- B. Ferrous-Alloy Ball Valves, General: MSS SP-72, with flanged ends.
- C. Ferrous-Alloy Ball Valves: Class 150, full port.

## 2.5 FERROUS-ALLOY BUTTERFLY VALVES

- A. Manufacturers:
  - 1. Flangeless, Ferrous-Alloy Butterfly Valves:
    - a. Crane Co.; Crane Valve Group; Center Line.
    - b. Crane Co.; Crane Valve Group; Stockham Div.
    - c. Dover Corp.; Dover Resources Company; Norriseal Div.
    - d. General Signal; DeZurik Unit.

- e. Grinnell Corporation.
    - f. Hammond Valve.
    - g. Metraflex Co.
    - h. Milwaukee Valve Company.
    - i. Mueller Steam Specialty.
    - j. NIBCO INC.
    - k. Red-White Valve Corp.
    - l. Tyco International, Ltd.; Tyco Valves & Controls.
    - m. Watts Industries, Inc.; Water Products Div.
  - 2. Flanged, Ferrous-Alloy Butterfly Valves:
    - a. Cooper Cameron Corp.; Cooper Cameron Valves Div.
    - b. Grinnell Corporation.
    - c. Mueller Steam Specialty.
    - d. Tyco International, Ltd.; Tyco Valves & Controls.
  - 3. Grooved-End, Ductile-Iron Butterfly Valves:
    - a. Central Sprinkler Co.; Central Grooved Piping Products.
    - b. Grinnell Corporation.
    - c. Hammond Valve.
    - d. McWane, Inc.; Kennedy Valve Div.
    - e. Milwaukee Valve Company.
    - f. Mueller Steam Specialty.
    - g. NIBCO INC.
    - h. Victaulic Co. of America.
  - B. Ferrous-Alloy Butterfly Valves, General: MSS SP-67, Type I, for tight shutoff, with disc and lining suitable for potable water, unless otherwise indicated.
  - C. Flanged, 150-psig CWP Rating, Ferrous-Alloy Butterfly Valves: Flanged-end type with one-piece stem.
  - D. Grooved-End, 175-psig CWP Rating, Ferrous-Alloy Butterfly Valves: Ductile-iron or steel body with grooved or shouldered ends.
- 2.6 BRONZE CHECK VALVES
- A. Manufacturers:
    - 1. Type 1, Bronze, Horizontal Lift Check Valves with Metal Disc:
      - a. Cincinnati Valve Co.
      - b. Crane Co.; Crane Valve Group; Crane Valves.
      - c. Crane Co.; Crane Valve Group; Stockham Div.
      - d. Red-White Valve Corp.
    - 2. Type 2, Bronze, Horizontal Lift Check Valves with Nonmetallic Disc:
      - a. Cincinnati Valve Co.
      - b. Crane Co.; Crane Valve Group; Crane Valves.
      - c. Crane Co.; Crane Valve Group; Jenkins Valves.
      - d. Crane Co.; Crane Valve Group; Stockham Div.
    - 3. Type 1, Bronze, Vertical Lift Check Valves with Metal Disc:
      - a. Cincinnati Valve Co.
      - b. Crane Co.; Crane Valve Group; Crane Valves.
      - c. Crane Co.; Crane Valve Group; Jenkins Valves.

- d. Red-White Valve Corp.
    - 4. Type 2, Bronze, Vertical Lift Check Valves with Nonmetallic Disc:
      - a. Grinnell Corporation.
      - b. Milwaukee Valve Company.
    - 5. Type 3, Bronze, Swing Check Valves with Metal Disc:
      - a. Cincinnati Valve Co.
      - b. Crane Co.; Crane Valve Group; Jenkins Valves.
      - c. Crane Co.; Crane Valve Group; Stockham Div.
      - d. Grinnell Corporation.
      - e. Hammond Valve.
      - f. Milwaukee Valve Company.
      - g. NIBCO INC.
      - h. Powell, Wm. Co.
      - i. Red-White Valve Corp.
      - j. Watts Industries, Inc.; Water Products Div.
    - 6. Type 4, Bronze, Swing Check Valves with Nonmetallic Disc:
      - a. Cincinnati Valve Co.
      - b. Crane Co.; Crane Valve Group; Jenkins Valves.
      - c. Crane Co.; Crane Valve Group; Stockham Div.
      - d. Grinnell Corporation.
      - e. Hammond Valve.
      - f. McWane, Inc.; Kennedy Valve Div.
      - g. Milwaukee Valve Company.
      - h. NIBCO INC.
      - i. Red-White Valve Corp.
      - j. Watts Industries, Inc.; Water Products Div.
  - B. Bronze Check Valves, General: MSS SP-80.
  - C. Type 1, Class 150, Bronze, Horizontal Lift Check Valves: Bronze body with bronze disc and seat.
  - D. Type 1, Class 150, Bronze, Vertical Lift Check Valves: Bronze body with bronze disc and seat.
  - E. Type 2, Class 150, Bronze, Horizontal Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.
  - F. Type 2, Class 150, Bronze, Vertical Lift Check Valves: Bronze body with nonmetallic disc and bronze seat.
  - G. Type 3, Class 150, Bronze, Swing Check Valves: Bronze body with bronze disc and seat.
  - H. Type 4, Class 150, Bronze, Swing Check Valves: Bronze body with nonmetallic disc and bronze seat.
- 2.7 FERROUS-ALLOY WAFER CHECK VALVES
- A. Available Manufacturers:
    - 1. Single-Plate, Ferrous-Alloy, Wafer Check Valves:
      - a. McWane, Inc.; Kennedy Valve Div.
      - b. Mueller Co.
      - c. Techno Corp.



- d. Tyco International, Ltd.; Tyco Valves & Controls.
    - e. Wheatley Gaso, Inc.
  - 2. Dual-Plate, Ferrous-Alloy, Wafer Check Valves:
    - a. Crane Co.; Crane Valve Group; Stockham Div.
    - b. Flomatic Valves.
    - c. Grinnell Corporation.
    - d. Gulf Valve Co.
    - e. Metraflex Co.
    - f. Mueller Steam Specialty.
    - g. NIBCO INC.
    - h. Red-White Valve Corp.
    - i. Watts Industries, Inc.; Water Products Div.
  - 3. Dual-Plate, Ferrous-Alloy, Wafer-Lug Check Valves:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Valve and Primer Corp.
  - 4. Dual-Plate, Ferrous-Alloy, Double-Flanged-Type Check Valves:
    - a. Crane Co.; Crane Valve Group; Crane Valves.
    - b. Gulf Valve Co.
  - B. Ferrous-Alloy Wafer Check Valves, General: API 594, spring loaded.
  - C. Single-Plate, Class 125 or 150, Ferrous-Alloy, Wafer Check Valves: Flangeless body.
  - D. Single-Plate, Class 125 or 150, Ferrous-Alloy, Wafer-Lug Check Valves: Single-flange body.
  - E. Single-Plate, Class 125 or 150, Ferrous-Alloy, Double-Flanged Check Valves: Flanged-end body.
  - F. Dual-Plate, Class 125 or 150, Ferrous-Alloy, Wafer Check Valves: Flangeless body.
  - G. Dual-Plate, Class 125 or 150, Ferrous-Alloy, Wafer-Lug Check Valves: Single-flange body.
  - H. Dual-Plate, Class 125 or 150, Ferrous-Alloy, Double-Flanged Check Valves: Flanged-end body.
- 2.8 SPRING-LOADED, LIFT-DISC CHECK VALVES
- A. Available Manufacturers:
  - B. Manufacturers:
    - 1. Type I, Wafer Lift-Disc Check Valves:
      - a. Mueller Steam Specialty.
    - 2. Type II, Compact-Wafer, Lift-Disc Check Valves:
      - a. Flomatic Valves.
      - b. Grinnell Corporation.
      - c. Hammond Valve.
      - d. Metraflex Co.
      - e. Milwaukee Valve Company.
      - f. Mueller Steam Specialty.
      - g. NIBCO INC.

- h. Val-Matic Valve & Mfg. Corp.
    - 3. Type III, Globe Lift-Disc Check Valves:
      - a. Flomatic Valves.
      - b. Grinnell Corporation.
      - c. Hammond Valve.
      - d. Metraflex Co.
      - e. Milwaukee Valve Company.
      - f. NIBCO INC.
      - g. SSI Equipment, Inc.
      - h. Val-Matic Valve & Mfg. Corp.
    - 4. Type IV, Threaded Lift-Disc Check Valves:
      - a. Grinnell Corporation.
      - b. Metraflex Co.
      - c. Milwaukee Valve Company.
      - d. Mueller Steam Specialty.
      - e. NIBCO INC.
      - f. Watts Industries, Inc.; Water Products Div.
  - C. Lift-Disc Check Valves, General: FCI 74-1, with spring-loaded bronze or alloy disc and bronze or alloy seat.
  - D. Type I, Class 125, Wafer Lift-Disc Check Valves: Wafer style with cast-iron shell with diameter matching companion flanges.
  - E. Type III, Class 125, Globe Lift-Disc Check Valves: Globe style with cast-iron shell and flanged ends.
  - F. Type IV, Class 125, Threaded Lift-Disc Check Valves: Threaded style with bronze shell and threaded ends.
  - G. Type IV, Class 150, Threaded Lift-Disc Check Valves: Threaded style with bronze shell and threaded ends.
- 2.9 BRONZE GATE VALVES
- A. Available Manufacturers:
    - 1. Type 1, Bronze, Nonrising-Stem Gate Valves:
      - a. Cincinnati Valve Co.
      - b. Crane Co.; Crane Valve Group; Jenkins Valves.
      - c. Crane Co.; Crane Valve Group; Stockham Div.
      - d. Grinnell Corporation.
      - e. Hammond Valve.
      - f. Milwaukee Valve Company.
      - g. NIBCO INC.
      - h. Powell, Wm. Co.
      - i. Red-White Valve Corp.
      - j. Watts Industries, Inc.; Water Products Div.
    - 2. Type 2, Bronze, Rising-Stem, Solid-Wedge Gate Valves:
      - a. Cincinnati Valve Co.
      - b. Crane Co.; Crane Valve Group; Jenkins Valves.
      - c. Crane Co.; Crane Valve Group; Stockham Div.
      - d. Grinnell Corporation.

- e. Hammond Valve.
- f. Milwaukee Valve Company.
- g. NIBCO INC.
- h. Powell, Wm. Co.
- i. Red-White Valve Corp.

3. Type 3, Bronze, Rising-Stem, Split-Wedge Gate Valves:

- a. Cincinnati Valve Co.
- b. Crane Co.; Crane Valve Group; Jenkins Valves.
- c. Grinnell Corporation.
- d. NIBCO INC.

B. Bronze Gate Valves, General: MSS SP-80, with ferrous-alloy handwheel.

C. Type 1, Class 125, Bronze Gate Valves: Bronze body with nonrising stem and bronze solid wedge and union-ring bonnet.

D. Type 1, Class 150, Bronze Gate Valves: Bronze body with nonrising stem and bronze solid wedge and union-ring bonnet.

E. Type 2, Class 125, Bronze Gate Valves: Bronze body with rising stem and bronze solid wedge and union-ring bonnet.

F. Type 2, Class 150, Bronze Gate Valves: Bronze body with rising stem and bronze solid wedge and union-ring bonnet.

G. Type 3, Class 125, Bronze Gate Valves: Bronze body with rising stem and bronze split wedge and union-ring bonnet.

H. Type 3, Class 150, Bronze Gate Valves: Bronze body with rising stem and bronze split wedge and union-ring bonnet.

## 2.10 CAST-IRON GATE VALVES

A. Available Manufacturers:

1. Type I, Cast-Iron, Nonrising-Stem Gate Valves:

- a. Cincinnati Valve Co.
- b. Crane Co.; Crane Valve Group; Jenkins Valves.
- c. Crane Co.; Crane Valve Group; Stockham Div.
- d. Grinnell Corporation.
- e. Hammond Valve.
- f. Milwaukee Valve Company.
- g. NIBCO INC.
- h. Powell, Wm. Co.
- i. Red-White Valve Corp.
- j. Watts Industries, Inc.; Water Products Div.

2. Type I, Cast-Iron, Rising-Stem Gate Valves:

- a. Cincinnati Valve Co.
- b. Crane Co.; Crane Valve Group; Jenkins Valves.
- c. Crane Co.; Crane Valve Group; Stockham Div.
- d. Grinnell Corporation.
- e. Hammond Valve.
- f. Milwaukee Valve Company.
- g. NIBCO INC.

- h. Powell, Wm. Co.
  - i. Red-White Valve Corp.
  - j. Watts Industries, Inc.; Water Products Div.
- B. Cast-Iron Gate Valves, General: MSS SP-70, Type I.
- C. Class 125, NRS, Bronze-Mounted, Cast-Iron Gate Valves: Cast-iron body with bronze trim, nonrising stem, and solid-wedge disc.
- D. Class 125, OS&Y, Bronze-Mounted, Cast-Iron Gate Valves: Cast-iron body with bronze trim, rising stem, and solid-wedge disc.
- E. Class 125, NRS, All-Iron, Cast-Iron Gate Valves: Cast-iron body with cast-iron trim, nonrising stem, and solid-wedge disc.
- F. Class 125, OS&Y, All-Iron, Cast-Iron Gate Valves: Cast-iron body with cast-iron trim, rising stem, and solid-wedge disc.

## 2.11 BRONZE GLOBE VALVES

- A. Available Manufacturers:
  - 1. Type 1, Bronze Globe Valves with Metal Disc:
    - a. Cincinnati Valve Co.
    - b. Crane Co.; Crane Valve Group; Jenkins Valves.
    - c. Crane Co.; Crane Valve Group; Stockham Div.
    - d. Grinnell Corporation.
    - e. Hammond Valve.
    - f. Milwaukee Valve Company.
    - g. NIBCO INC.
    - h. Powell, Wm. Co.
    - i. Red-White Valve Corp.
  - 2. Type 2, Bronze Globe Valves with Nonmetallic Disc:
    - a. Cincinnati Valve Co.
    - b. Crane Co.; Crane Valve Group; Jenkins Valves.
    - c. Crane Co.; Crane Valve Group; Stockham Div.
    - d. Grinnell Corporation.
    - e. Hammond Valve.
    - f. McWane, Inc.; Kennedy Valve Div.
    - g. Milwaukee Valve Company.
    - h. NIBCO INC.
    - i. Powell, Wm. Co.
    - j. Red-White Valve Corp.
  - 3. Type 3, Bronze Globe Valves with Renewable Seat and Metal Disc:
    - a. Cincinnati Valve Co.
    - b. Crane Co.; Crane Valve Group; Jenkins Valves.
    - c. Crane Co.; Crane Valve Group; Stockham Div.
    - d. Grinnell Corporation.
    - e. Hammond Valve.
    - f. Milwaukee Valve Company.
    - g. NIBCO INC.
- B. Bronze Globe Valves, General: MSS SP-80, with ferrous-alloy handwheel.

- C. Type 1, Class 125, Bronze Globe Valves: Bronze body with bronze disc.
- D. Type 1, Class 150, Bronze Globe Valves: Bronze body with bronze disc.
- E. Type 2, Class 125, Bronze Globe Valves: Bronze body with nonmetallic PTFE disc and union-ring bonnet.
- F. Type 2, Class 150, Bronze Globe Valves: Bronze body with nonmetallic PTFE disc and union-ring bonnet.
- G. Type 3, Class 125, Bronze Globe Valves: Bronze body with bronze disc and renewable seat.
- H. Type 3, Class 150, Bronze Globe Valves: Bronze body with bronze disc and renewable seat.

## PART 3 - 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, butterfly valves.
  - 2. Throttling Service: Angle, ball, butterfly, or globe valves.
  - 3. Pump Discharge: Spring-loaded, lift-disc check 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 and Smaller: One-piece, 400-psig CWP rating, copper alloy.
  - 2. Ball Valves, NPS 2-1/2 and Larger: Class 150, ferrous alloy.
  - 3. Butterfly Valves, NPS 2-1/2 and Larger: Flangeless, 150-psig CWP rating, ferrous alloy, with EPDM liner.
  - 4. Grooved-End, Ductile-Iron Butterfly Valves, NPS 2-1/2 and Larger: 175-psig CWP rating.

5. Lift Check Valves, NPS 2 and Smaller: Type 2, Class 150, horizontal or vertical, bronze.
6. Swing Check Valves, NPS 2 and Smaller: Type 4, Class 150, bronze.
7. Swing Check Valves, NPS 2-1/2 and Larger: Type II, Class 250, gray iron.
8. Grooved-End, Ductile-Iron, Swing Check Valves, NPS 2-1/2 and Larger: 175-psigCWP rating.
9. Wafer Check Valves, NPS 2-1/2 and Larger: Dual-plate, wafer, Class 150, ferrous alloy.
10. Spring-Loaded, Lift-Disc Check Valves, NPS 2 and Smaller: Type IV, Class 150.
11. Gate Valves, NPS 2 and Smaller: Type 1, Class 150, bronze.
12. Gate Valves, NPS 2-1/2 and Larger: Type I, Class 125, bronze-mounted cast iron.
13. Globe Valves, NPS 2 and Smaller: Type 2, Class 150, bronze.
14. Globe Valves, NPS 2-1/2 and Larger: Type I, Class 125, bronze-mounted cast iron.
15. Plug Valves, NPS 2 and Larger: Class 150, lubricated type with FDA-approved-material sealant, cast iron.

### 3.3 VALVE INSTALLATION

- A. Piping installation requirements are specified in other Division 15 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.
- F. Install check valves for proper direction of flow and as follows:
  1. Swing Check Valves: In horizontal position with hinge pin level.
  2. Dual-Plate Check Valves: In horizontal or vertical position, between flanges.
  3. Lift Check Valves: With stem upright and plumb.

### 3.4 JOINT CONSTRUCTION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping joint construction.
- B. Grooved Joints: Assemble joints with keyed coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- C. 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 220523

## **SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**

### **PART 1 GENERAL**

#### **1.01 RELATED DOCUMENTS**

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

#### **1.02 SUMMARY**

- A. This Section includes hangers and supports for mechanical system piping and equipment.

#### **1.03 DEFINITIONS**

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

#### **1.04 PERFORMANCE REQUIREMENTS**

- A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

#### **1.05 QUALITY ASSURANCE**

- A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

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

- 1. Pipe Hangers:

- a. B-Line Systems, Inc.
- b. Globe Pipe Hanger Products, Inc.
- c. Grinnell Corp.
- d. GS Metals Corp.
- e. National Pipe Hanger Corp.
- f. Piping Technology & Products, Inc.

- 2. Channel Support Systems:

- a. B-Line Systems, Inc.

- b. Grinnell Corp.; Power-Strut Unit.
  - c. GS Metals Corp.
  - d. Thomas & Betts Corp.
  - e. Unistrut Corp.
3. Powder-Actuated Fastener Systems:
- a. Hilti, Inc.
  - b. ITW Ramset/Red Head.
  - c. Masterset Fastening Systems, Inc.

## 2.02 MANUFACTURED UNITS

- A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components.
- 1. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
  - 2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- B. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.
- 1. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
  - 2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

## 2.03 MISCELLANEOUS MATERIALS

- A. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- C. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.
- D. Grout: ASTM C 1107, Grade B, factory-mixed and -packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.
- 1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
  - 2. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 3. Design Mix: 5000-psi, 28-day compressive strength.

## PART 3 EXECUTION



### 3.01 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger requirements are specified in Sections specifying equipment and systems.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.
- C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
  - 1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
  - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
  - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
  - 4. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
  - 5. Adjustable Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
  - 6. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
  - 7. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
  - 8. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
  - 9. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
  - 10. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
  - 11. U-Bolts (MSS Type 24): For support of heavy pipe, NPS 1/2 to NPS 30.
  - 12. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  - 13. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
- D. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
  - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
  - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

- E. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
  - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
  - 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  - 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  - 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- F. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
  - 1. C-Clamps (MSS Type 23): For structural shapes.
  - 2. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  - 3. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  - 4. Plate Lugs (MSS Type 57): For attaching to beams if flexibility at beam is required.
  - 5. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where head room is limited.
- G. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification 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 by manufacturer to prevent crushing insulation.
  - 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi minimum compressive-strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

### 3.02 HANGER AND SUPPORT INSTALLATION

- A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.
  - 1. Field assemble and install according to manufacturer's written instructions.
- C. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.

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.
- D. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, and at changes in direction of piping.
- E. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- F. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- G. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.
- H. 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.
  2. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span arc of 180 degrees.
  4. Shield Dimensions for Pipe: Not less than the following:
    - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
  5. Insert Material: Length at least as long as protective shield.
  6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.03 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

### 3.04 METAL FABRICATION

- A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes 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.

### 3.05 ADJUSTING

- A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

### 3.06 PAINTING

- A. Touching 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 a minimum dry film thickness of 2.0 mils.
- B. Touching Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 Section "Painting."

**END OF SECTION 220529**

## **SECTION 220553 - MECHANICAL IDENTIFICATION**

### **PART 1 GENERAL**

#### **1.01 RELATED DOCUMENTS**

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

#### **1.02 SUMMARY**

- A. This Section includes the following mechanical identification materials and their installation:

1. Equipment nameplates.
2. Equipment markers.
3. Equipment signs.
4. Access panel and door markers.
5. Pipe markers.
6. Stencils.
7. Valve tags.
8. Valve schedules.
9. Warning tags.

#### **1.03 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. Valve numbering scheme.
- D. Valve Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) to include in maintenance manuals.

#### **1.04 QUALITY ASSURANCE**

- A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

#### **1.05 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 location of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

## **PART 2 PRODUCTS**

### **2.01 EQUIPMENT IDENTIFICATION DEVICES**

- A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
  - 1. Data:
    - a. Manufacturer, product name, model number, and serial number.
    - b. Capacity, operating and power characteristics, and essential data.
    - c. Labels of tested compliances.
  - 2. Location: Accessible and visible.
  - 3. Fasteners: As required to mount on equipment.
- B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
  - 1. Terminology: Match schedules as closely as possible.
  - 2. Data:
    - a. Name and plan number.
    - b. Equipment service.
    - c. Design capacity.
    - d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
  - 3. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.
- C. Equipment Signs: ASTM D 709, Type I, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
  - 1. Data: Instructions for operation of equipment and for safety procedures.
  - 2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
  - 3. Thickness: 1/8 inch, unless otherwise indicated.
  - 4. Thickness: 1/16 inch for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
  - 5. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

- D. Access Panel and Door Markers: 1/16-inch- thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.

- 1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

## 2.02 PIPING IDENTIFICATION DEVICES

- A. Do not use pipe markers or plastic tapes for bare pipes conveying fluids at temperatures of 125 deg F (52 deg C) or higher.
- B. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
  - 1. Colors: Comply with ASME A13.1, unless otherwise indicated.
  - 2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
  - 3. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.
  - 4. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.
- C. Pretensioned Pipe Markers: Precoiled semirigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.
- D. Shaped Pipe Markers: Preformed semirigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.
- E. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.
- F. Plastic Tape: Continuously printed, vinyl tape at least 3 mils thick with pressure-sensitive, permanent-type, 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.

## 2.03 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door markers, equipment markers, equipment signs, and similar operational instructions.
  - 1. Stencil Material: Metal or fiberboard.
  - 2. Stencil Paint: Exterior, gloss, alkyd enamel black, unless otherwise indicated. Paint may be in pressurized spray-can form.
  - 3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1, unless otherwise indicated.

## 2.04 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers, with numbering scheme approved by Architect. Provide 5/32-inch hole for fastener.

- 1. Material: 3/32-inch- thick laminated plastic with 2 black surfaces and white inner layer.
- 2. Valve-Tag Fasteners: Brass wire-link chain.

#### 2.05 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.

- 1. Size: 3 by 5-1/4 inches
- 2. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
- 3. Color: Yellow background with black lettering.

### PART 3 EXECUTION

#### 3.01 APPLICATIONS, GENERAL

- A. Products specified are for applications referenced in other Division 15 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

#### 3.02 EQUIPMENT IDENTIFICATION

- A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:

- 1. Pumps, compressors, chillers, condensers, and similar motor-driven units.
- 2. Fans, blowers, primary balancing dampers, and mixing boxes.
- 3. Packaged HVAC central-station and zone-type units.

- B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.

- 1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
- 2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
- 3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:
  - a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
  - b. Fire department hose valves and hose stations.



- c. Meters, gages, thermometers, and similar units.
  - d. Fuel-burning units, including furnaces and heaters.
  - e. Pumps, compressors, condensers, and similar motor-driven units.
  - f. Heat exchangers, coils, evaporators, heat recovery units, and similar equipment.
  - g. Fans, blowers, primary balancing dampers, and mixing boxes.
  - h. Packaged HVAC central-station and zone-type units.
  - i. Tanks and pressure vessels.
  - j. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.
- C. Stenciled Equipment Marker Option: Stenciled markers may be provided instead of laminated-plastic equipment markers, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.
- D. Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible.
- 1. Identify mechanical equipment with equipment markers in the following color codes:
    - a. Green: For cooling equipment and components.
    - b. Yellow: For heating equipment and components.
    - c. Orange: For combination cooling and heating equipment and components.
  - 2. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  - 3. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
  - 4. Include signs for the following general categories of equipment:
    - a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
    - b. Fuel-burning units, including furnaces and heaters.
    - c. Pumps, compressors, condensers, and similar motor-driven units.
    - d. Heat exchangers, coils, evaporators, heat recovery units, and similar equipment.
    - e. Fans, blowers, primary balancing dampers, and mixing boxes.
    - f. Packaged HVAC central-station and zone-type units.

- g. Tanks and pressure vessels.
  - h. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.
- E. Stenciled Equipment Sign Option: Stenciled signs may be provided instead of laminated-plastic equipment signs, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.
- F. Install access panel markers with screws on equipment access panels.

### 3.03 PIPING IDENTIFICATION

- A. Do not use pipe markers and tapes for bare pipes conveying fluids at temperatures of 125 deg F (52 deg C) or higher.
- B. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
- 1. Pipes with OD, Including Insulation, Less Than 6 Inches: Pretensioned pipe markers. Use size to ensure a tight fit.
  - 2. Pipes with OD, Including Insulation, Less Than 6 Inches: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 3/4 inch wide, lapped at least 1-1/2 inches at both ends of pipe marker, and covering full circumference of pipe.
- C. Stenciled Pipe Marker Option: Stenciled markers may be provided instead of manufactured pipe markers, at Installer's option. Install stenciled pipe markers complying with ASME A13.1 on each piping system.
- 1. Identification Paint: Use for contrasting background.
  - 2. Stencil Paint: Use for pipe marking.
- D. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed 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 nonaccessible enclosures.
  - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  - 7. On piping above removable acoustical ceilings. Omit intermediately spaced markers.

### 3.04 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following:
  - 1. Valve-Tag Size and Shape:
    - a. Cold Water: 1-1/2 inches
    - b. Hot Water: 1-1/2 inches.
    - c. Fire Protection: 1-1/2 inches.
    - d. Gas: 1-1/2 inches.
  - 2. Valve-Tag Color:
    - a. Cold Water: Blue.
    - b. Hot Water: Green.
    - c. Fire Protection: Red.
    - d. Gas: Yellow.

### 3.05 VALVE-SCHEDULE INSTALLATION

- A. Mount valve schedule on wall in accessible location in each major equipment room.

### 3.06 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

### 3.07 ADJUSTING

- A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

### 3.08 CLEANING

- A. Clean faces of mechanical identification devices.

**END OF SECTION 220553**

## **SECTION 221116 – DOMESTIC WATER PIPING**

### **PART 1 GENERAL**

#### **1.01 RELATED DOCUMENTS**

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

#### **1.02 SUMMARY**

- A. This Section includes domestic water piping from locations indicated to fixtures and equipment inside the building.

#### **1.03 DEFINITIONS**

- A. PP: Polypropylene plastic.
- B. PVC: Polyvinyl chloride plastic.

#### **1.04 PERFORMANCE REQUIREMENTS**

- A. Provide components and installation capable of producing domestic water piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
  - 1. Combined Fire-Protection and Domestic Water Service Piping: 250 psig.
  - 2. Domestic Water Service Piping: 160 psig.
  - 3. Domestic Water Distribution Piping: 125 psig.
  - 4. Domestic Water Service Piping: 100 psig.
  - 5. Domestic Water Distribution Piping: 100 psig.

#### **1.05 QUALITY ASSURANCE**

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances," and NSF 61, "Drinking Water System Components-Health Effects; Sections 1 through 9," for combined fire-protection and domestic water service piping to building.
- C. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic, potable domestic water piping and components. Include marking "NSF-pw" on piping.
- D. Comply with NSF 61, "Drinking Water System Components-Health Effects; Sections 1 through 9," for potable domestic water piping and components.

### **PART 2 PRODUCTS**

## 2.01 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.
- B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
- C. Transition Couplings for Underground Pressure Piping: AWWA C219, metal, sleeve-type coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

## 2.02 STEEL PIPING

- A. Steel Pipe: ASTM A 53, Type E or S, Grade A or B, Schedule 40, galvanized. Include ends matching joining method.
  - 1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53 or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
  - 2. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface, and female threaded ends.
  - 3. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
  - 4. Cast-Iron Flanges: ASME B16.1, Class 125.
  - 5. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.
  - 6. Steel-Piping, Grooved-End Fittings: ASTM A 47, galvanized, malleable-iron casting; ASTM A 106, galvanized, steel pipe; or ASTM A 536, galvanized, ductile-iron casting; with dimensions matching steel pipe.
    - a. Steel-Piping, Keyed Couplings: AWWA C606, for steel-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.
  - 7. Steel-Piping, Expansion Joints: Compound, galvanized, steel fitting with telescoping body and slip-pipe section. Include packing rings, packing, limit rods, chrome-plated finish on slip-pipe sections, and flanged ends.
  - 8. Steel-Piping, Double Expansion Joints: Compound, galvanized, steel fitting with telescoping body and two slip-pipe sections. Include packing rings, packing, limit rods, chrome-plated finish on slip-pipe sections, and flanged ends.

## 2.03 COPPER TUBING

- A. Soft Copper Tube: ASTM B 88, Types K and L, water tube, annealed temper.

1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
  2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
  3. 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.
- B. Hard Copper Tube: ASTM B 88, Types L and M, water tube, drawn temper.
1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
  2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
  3. 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.
  4. Copper, Grooved-End Fittings: ASTM B 75 copper tube or ASTM B 584 bronze castings.
    - a. Copper-Tubing, Keyed Couplings: Copper-tube dimensions and design similar to AWWA C606. Include ferrous housing sections, gasket suitable for hot water, and bolts and nuts.
- 2.04 PVC PIPING
- A. PVC AWWA Pipe: AWWA C900, Class 150 and Class 200, with bell end with gasket and spigot end.
1. Provide piping listed for fire-protection service where indicated.
  2. PVC Fabricated Fittings: AWWA C900, Class 150 and Class 200, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
  3. PVC Molded Fittings: AWWA C907, Class 150, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.
  4. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron, standard pattern; or AWWA C153, ductile-iron, compact pattern.
    - a. Gaskets: AWWA C111, rubber.
  5. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron, standard pattern; or AWWA C153, ductile-iron, compact pattern.
    - a. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.05 VALVES

- A. Refer to Division 21 Section "Plumbing Specialties" for balancing and drain valves.

**PART 3 EXECUTION**

3.01 EXCAVATION

- A. Refer to Division 2 Section "Earthwork" for excavating, trenching, and backfilling.

3.02 PIPING APPLICATIONS

- 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 may be used on aboveground piping, unless otherwise indicated.
- C. Grooved joints may be used on aboveground grooved-end piping.
- D. Fitting Option: Mechanically formed tee-branch outlets and brazed joints may be used on aboveground copper tubing.
- E. Underground Combined Fire-Protection and Domestic Water Service Piping: Provide piping listed for fire-protection service and complying with NSF 61. Use the following piping materials for each size range:
  - 1. PVC Piping:
    - a. NPS 4 to NPS 8: PVC AWWA Class C900 pipe; PVC fabricated Class 200, molded Class 200 fittings; and restrained, gasketed joints.
- F. Underground Domestic Water Service Piping: Use the following piping materials for each size range:
  - 1. NPS 2 and Smaller: Soft copper tube, Type K Type L; copper pressure fittings; and soldered joints.
  - 2. NPS 2-1/2 to NPS 3-1/2: Soft copper tube, Type K Type L; copper pressure fittings; and soldered joints.
  - 3. NPS 2-1/2 to NPS 3-1/2: Use NPS 4 AWWA C900, PVC pipe; PVC fabricated or molded fittings; and restrained, gasketed joints.
  - 4. NPS 4 to NPS 8: Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile-iron fittings; and restrained, gasketed joints.
  - 5. NPS 4 to NPS 8: PVC AWWA Class C900 pipe; PVC fabricated Class 150 or molded Class 150 fittings; and restrained, gasketed joints.
- G. Aboveground Domestic Water Piping: Use the following piping materials for each size range:

1. NPS 1-1/2 and Smaller: Hard copper tube, Type L Type M; copper pressure fittings; and soldered joints.
  2. NPS 2: Hard copper tube, Type L Type M; copper pressure fittings; and soldered joints.
  3. NPS 2: Hard copper tube, Type L Type M with grooved ends; copper grooved-end fittings; copper-tubing, keyed couplings; and grooved joints.
  4. NPS 2-1/2 to NPS 3-1/2: Hard copper tube, Type L Type M; copper pressure fittings; and soldered joints.
  5. NPS 2-1/2 to NPS 3-1/2: Use NPS 2-1/2 to NPS 4 hard copper tube, Type L with grooved ends; copper grooved-end fittings; copper-tubing, keyed couplings; and grooved joints.
  6. NPS 4 to NPS 6: Hard copper tube, Type L Type M; copper pressure fittings; and soldered joints.
  7. NPS 4 to NPS 6: Hard copper tube, Type L Type M with grooved ends; copper grooved-end fittings; copper-tubing, keyed couplings; and grooved joints.
- H. Underground Domestic Water Piping NPS 4 and Smaller: Soft or hard copper tube, Type L; copper pressure fittings; and soldered joints.

### 3.03 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
1. Shutoff Duty: Use bronze ball or gate valves for piping NPS 2 and smaller. Use cast-iron butterfly or gate valves with flanged ends for piping NPS 2-1/2 and larger.
  2. Throttling Duty: Use bronze ball or globe valves for piping NPS 2 and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 and larger.
  3. Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.
  4. Drain Duty: Hose-end drain valves.
- B. Cast-iron, grooved-end valves may be used with grooved-end piping.

### 3.04 PIPING INSTALLATION

- A. Extend domestic water service piping to exterior water distribution piping in sizes and locations indicated.
- B. Install underground PVC piping according to ASTM D 2774 and ASTM F 645. Install buried piping inside building between wall and floor penetrations and connection to water service piping outside building with restrained joints. Anchor pipe to wall or floor. Install thrust-block supports at vertical and horizontal offsets.



- C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for sleeves and mechanical sleeve seals.
- D. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for wall penetration systems.
- E. Install shutoff valve, hose-end drain valve, strainer, Reduced Pressure Backflow Preventer, pressure gage, and test tee with valve, inside building at each domestic water service.
- F. Install aboveground domestic water piping level without pitch and plumb.
- G. Fill water piping. Check components to determine that they are not air bound and that piping is full of water.
- H. Perform the following steps 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 plugs used for temporary sealing of piping during installation.
  - 5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
  - 6. Remove filter cartridges from housings, and verify that cartridges are as specified for application where used and that cartridges are clean and ready for use.
- I. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.
- J. Check plumbing specialties and verify proper settings, adjustments, and operation.
  - 1. Water-Pressure Regulators: Set outlet pressure at 80 psig maximum, unless otherwise indicated.
- K. Energize pumps and verify proper operation.

### 3.05 JOINT CONSTRUCTION

- A. 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.
- B. Grooved Joints: Assemble joints with keyed-coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

- C. Mechanically Formed Outlets: Form tee in copper tube according to equipment manufacturer's written instructions. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

### 3.06 ROUGHING-IN FOR WATER METERS

- A. Rough-in domestic water piping for water meter installation according to utility company's requirements. Water meters will be furnished by utility. Provide concrete vault as required by utility.

### 3.07 VALVE INSTALLATION

- A. Install sectional valve close to water main on each branch and riser serving plumbing fixtures or equipment. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.
- B. Install shutoff valve on each water supply to equipment and on each water supply to plumbing fixtures without supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.
- C. Install drain valves for equipment, at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
  - 1. Install hose-end drain valves at low points in water mains, risers, and branches.
  - 2. Install stop-and-waste drain valves where indicated.
- D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 and smaller and butterfly valves for piping NPS 2-1/2 and larger. Refer to Division 221119 Section "Plumbing Specialties" for balancing valves.
- E. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Refer to Division 221119 Section "Plumbing Specialties" for calibrated balancing valves.

### 3.08 HANGER AND SUPPORT INSTALLATION

- A. Refer to Division 220529 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:
  - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
- B. Install supports according to Division 15 Section "Hangers and Supports."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
  1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
  2. NPS 1-1/2: 108 inches with 3/8-inch rod.
  3. NPS 2: 10 feet with 3/8-inch rod.
  4. NPS 2-1/2: 11 feet with 1/2-inch rod.
  5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
- F. Install supports for vertical steel piping every 15 feet.
- G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
  2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
  3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
  4. NPS 2-1/2: 108 inches with 1/2-inch rod.

### 3.09 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to exterior water service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to service piping with shutoff valve, and extend and connect to the following:
  1. Water Heaters: Cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.

2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 224110 Section "Plumbing Fixtures."
3. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

### 3.10 FIELD QUALITY CONTROL

#### A. Inspect domestic water piping as follows:

1. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
  - 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 for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
  - c. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
  - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

#### B. Test domestic water piping as follows:

1. 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 separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced domestic water piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
4. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

### 3.11 ADJUSTING

- A. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
  - 1. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
  - 2. Adjust calibrated balancing valves to flows indicated.

### 3.12 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
  - 1. Purge new piping and parts of existing domestic water piping that have been altered, extended, or repaired before using.
  - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction or, if methods are not prescribed, procedures described in either AWWA C651 or AWWA C652 or as 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:
      - (i) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
      - (ii) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
    - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- B. Prepare and submit reports of purging and disinfecting activities.
- C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

**END OF SECTION 221116**

## **SECTION 221316 - SANITARY WASTE AND VENT PIPING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section includes soil and waste, sanitary drainage and vent piping inside the building and to locations indicated.

#### **1.3 DEFINITIONS**

- A. The following are industry abbreviations for plastic piping materials:
  - 1. PE: Polyethylene plastic.
  - 2. PVC: Polyvinyl chloride plastic.

#### **1.4 PERFORMANCE REQUIREMENTS**

- A. Provide components and installation capable of producing piping systems with the following minimum working-pressure ratings, unless otherwise indicated:
  - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

#### **1.5 QUALITY ASSURANCE**

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

### **PART 2 - PRODUCTS**

#### **2.1 PIPING MATERIALS**

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

- B. Flexible Transition Couplings for Underground Nonpressure Piping: ASTM C 1173 with elastomeric sleeve. Include ends of same sizes as piping to be joined and include corrosion-resistant metal band on each end.
- C. Transition Couplings for Underground Pressure Piping: AWWA C219 metal, sleeve-type coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
- D. No ABS piping will be allowed.
- E. PVC may be used in non-plenum ceilings if insulated.

## 2.2 CAST-IRON SOIL PIPING

- A. Hub-and-Spigot Pipe and Fittings: ASTM A 74, Service class.
  - 1. Gaskets: ASTM C 564, rubber.
- B. Hubless Pipe and Fittings: ASTM A 888 or CISPI 301.
  - 1. Couplings: ASTM C 1277 assembly of metal housing, corrosion-resistant fasteners, and ASTM C 564 rubber sleeve with integral, center pipe stop.
    - a. Heavy-Duty, Type 304, Stainless-Steel Couplings: ASTM A 666, Type 304, stainless-steel shield; stainless-steel bands; and sleeve.
      - 1) NPS 1-1/2 to NPS 4: 3-inch- wide shield with 4 bands.
      - 2) NPS 5 to NPS 10: 4-inch- wide shield with 6 bands.
    - b. Heavy-Duty, FM-Approved Couplings: ASTM A 666, Type 304, stainless-steel housing; stainless-steel bands; and sleeve.
      - 1) NPS 1-1/2 to NPS 4: 3-inch- wide housing with 2 bands.
      - 2) NPS 5 to NPS 10: 4-inch- wide housing with 2 bands.
    - c. Heavy-Duty, Cast-Iron Couplings: ASTM A 48, 2-piece, cast-iron housing; stainless-steel bolts and nuts; and sleeve.
    - d. Heavy-Duty, Type 301, Stainless-Steel Couplings: ASTM A 666, Type 301, stainless-steel shield; stainless-steel bands; and sleeve.
      - 1) NPS 1-1/2 to NPS 4: 3-inch- wide shield with 4 bands.
      - 2) NPS 5 to NPS 10: 4-inch- wide shield with 6 bands.
    - e. Compact, Stainless-Steel Couplings: CISPI 310 with ASTM A 167, Type 301, or ASTM A 666, Type 301, stainless-steel corrugated shield; stainless-steel bands; and sleeve.
      - 1) NPS 1-1/2 to NPS 4: 2-1/8-inch- wide shield with 2 bands.

## 2.3 COPPER TUBING

- A. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
  - 1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- B. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.
  - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
  - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.
  - 3. 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.
- C. Hard Copper Tube: ASTM B 88, Types L and M, water tube, drawn temper.
  - 1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
  - 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end.
  - 3. 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.

## 2.4 PVC PIPING

- A. PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.
  - 1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.
- B. Schedule 40, PVC Pipe: ASTM F 891, Schedule 40.
  - 1. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.
- C. Cellular-Core, Sewer and Drain Series, PVC Pipe: ASTM F 891, Series PS 100.
  - 1. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Series PS 100 sewer and drain pipe.
- D. PVC Special Fittings: ASTM F 409, drainage-pattern tube and tubular fittings with ends as required for application.

## PART 3 - EXECUTION

### 3.1 EXCAVATION

- A. Refer to Section "Earthwork" for excavating, trenching, and backfilling.



### 3.2 PIPING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.
- B. Flanges may be used on aboveground pressure piping, unless otherwise indicated.
- C. Aboveground, Soil, Waste, and Vent Piping: Use the following piping materials for each size range:
  - 1. NPS 1-1/4 and NPS 1-1/2: Use NPS 1-1/2 hubless, cast-iron soil piping and one of the following:
    - a. Couplings: Heavy-duty, Type 301 or 304, stainless steel.
    - b. Couplings: Compact, stainless steel.
  - 2. NPS 1-1/4 and NPS 1-1/2: Copper DWV tube, copper drainage fittings, and soldered joints.
  - 3. NPS 1-1/4 and NPS 1-1/2: PVC pipe, PVC socket fittings, and solvent-cemented joints (where approved).
  - 4. NPS 1-1/4 and NPS 1-1/2: Cellular-core, Schedule 40, PVC pipe; PVC socket fittings; and solvent-cemented joints (where approved).
  - 5. NPS 2 to NPS 4: Service class, cast-iron soil piping; gaskets; and gasketed joints.
  - 6. NPS 2 to NPS 4: Hubless, cast-iron soil piping and one of the following:
    - a. Couplings: Heavy-duty, Type 301 or 304, stainless steel.
    - b. Couplings: Compact, stainless steel.
  - 7. NPS 2 to NPS 4: Copper DWV tube, copper drainage fittings, and soldered joints.
    - a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2: Hard copper tube, Type M; copper pressure fittings; and soldered joints.
  - 8. NPS 2 to NPS 4: PVC pipe, PVC socket fittings, and solvent-cemented joints (where approved).
  - 9. NPS 2 to NPS 4: Cellular-core, Schedule 40, PVC pipe; PVC socket fittings; and solvent-cemented joints (where approved).
- D. Underground, Soil, Waste, and Vent Piping: Use the following piping materials for each size range:
  - 1. NPS 1-1/2: Hubless, cast-iron soil piping and one of the following:
    - a. Couplings: Heavy-duty, Type 301 or 304, stainless steel.
    - b. Couplings: Compact, stainless steel.
  - 2. NPS 1-1/2: PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 3. NPS 1-1/2: Cellular-core, PVC pipe; PVC socket fittings; and solvent-cemented joints.
  - 4. NPS 2 to NPS 4: Service class, cast-iron soil piping; gaskets; and gasketed joints.
  - 5. NPS 2 to NPS 4: Extra-Heavy class, cast-iron soil piping; gaskets; and gasketed joints.
  - 6. NPS 2 to NPS 4: Hubless, cast-iron soil piping and one of the following:

- a. Couplings: Heavy-duty, Type 301 or 304, stainless steel.
  - b. Couplings: Compact, stainless steel.
- 7. NPS 2 to NPS 4: PVC pipe, PVC socket fittings, and solvent-cemented joints.
- 8. NPS 2 to NPS 4: Cellular-core, Schedule 40, PVC pipe; PVC socket fittings; and solvent-cemented joints.
- 9. NPS 2 to NPS 4: Use NPS 3 and NPS 4 cellular-core, Sewer and Drain Series, PVC pipe; PVC socket fittings; and solvent-cemented joints.
  - a. Couplings: Heavy-duty, Type 301 or 304, stainless steel.
  - b. Couplings: Compact, stainless steel.

### 3.3 PIPING INSTALLATION

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for basic piping installation.
- B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- C. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.
- D. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for sleeves and mechanical sleeve seals.
- E. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for wall penetration systems.
- F. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
  - 1. Encase underground piping with PE film according to ASTM A 674 or AWWA C105.
- G. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- H. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

- I. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
  - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
  - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
  - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- J. Install engineered soil and waste drainage and vent piping systems in locations indicated and as follows:
  - 1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
  - 2. Cast-Iron, Sovent, Single Stack: Comply with ASSE 1043 and sovent fitting manufacturer's written installation instructions. (Plumber may use sovent with Engineer’s approval.)
  - 3. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.
- K. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- L. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.
- M. Install underground PVC soil and waste drainage piping according to ASTM D 2321.
- N. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

### 3.4 JOINT CONSTRUCTION

- A. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
  - 1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
  - 2. Hubless Joints: Make with rubber gasket and sleeve or clamp.
- 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.
- C. Grooved Joints: Assemble joint with keyed coupling, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.
- D. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

### 3.5 VALVE INSTALLATION

- A. Refer to Division 220523 Section "Valves" for general-duty valves.
  - 1. Use gate or full-port ball valve for piping NPS 2 and smaller.
  - 2. Use gate valve for piping NPS 2-1/2 and larger.

- B. Check Valves: Install swing check valve, downstream from shutoff valve, on each sewage pump discharge.

### 3.6 HANGER AND SUPPORT INSTALLATION

- A. Refer to Division 15 Section "Hangers and Supports" for pipe hanger and support devices. Install the following:
  - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 15 Section "Hangers and Supports."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
  - 2. NPS 3: 60 inches with 1/2-inch rod.
  - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
  - 4. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/4: 84 inches with 3/8-inch rod.
  - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
  - 3. NPS 2: 10 feet with 3/8-inch rod.
  - 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
  - 5. NPS 3: 12 feet with 1/2-inch rod.
  - 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
- H. Install supports for vertical steel piping every 15 feet.
- I. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/4: 72 inches with 3/8-inch rod.
2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
3. NPS 2-1/2: 108 inches with 1/2-inch rod.
4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.

J. Install supports for vertical copper tubing every 10 feet.

K. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.

L. Install supports for vertical PVC piping every 48 inches.

M. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Plumbing Fixtures."
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Plumbing Specialties."
4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

### 3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
  - C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
  - D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
    1. 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 separate report for each test, complete with diagram of portion of piping tested.
    2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
    3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
    4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
    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 required corrective action.

### 3.9 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

### 3.10 PROTECTION

- A.** Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

**END OF SECTION 221316**

## **SECTION 224200 - PLUMBING FIXTURES**

### **PART 1 -**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section includes plumbing fixtures and related components.
- B. Related Sections include the following:
  - 1. Section "Plumbing Specialties" for backflow preventers and specialty fixtures not in this Section.

#### **1.3 DEFINITIONS**

- A. Accessible Fixture: Plumbing fixture that can be approached, entered, and used by people with disabilities.
- B. Fitting: Device that controls flow of water into or out of plumbing fixture. Fittings specified in this Section include supplies and stops, faucets and spouts, shower heads and tub spouts, drains and tailpieces, and traps and waste pipes. Piping and general-duty valves are included where indicated.

#### **1.4 SUBMITTALS**

- A. Product Data: Include selected fixture and trim, fittings, accessories, appliances, appurtenances, equipment, and supports and indicate materials and finishes, dimensions, construction details, and flow-control rates for each type of fixture indicated.
- B. Maintenance Data: For plumbing fixtures to include in maintenance manuals specified in Division 1.

#### **1.5 QUALITY ASSURANCE**

- A. Source Limitations: Obtain plumbing fixtures, faucets, and other components of each category through one source from a single manufacturer.



1. Exception: If fixtures, faucets, or other components are not available from a single manufacturer, obtain similar products from other manufacturers specified for that category.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; about plumbing fixtures for people with disabilities.
- D. Regulatory Requirements: Comply with requirements in U.S. Architectural & Transportation Barriers Compliance Board's "Uniform Federal Accessibility Standards (UFAS), 1985-494-187" about plumbing fixtures for people with disabilities.
- E. Regulatory Requirements: Comply with requirements in Public Law 102-486, "Energy Policy Act," about water flow and consumption rates for plumbing fixtures.
- F. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.
- G. Select combinations of fixtures and trim, faucets, fittings, and other components that are compatible.
- H. Comply with the following applicable standards and other requirements specified for plumbing fixtures:
  1. Hand Sinks: NSF 2 construction.
  2. Plastic Laundry Trays: ANSI Z124.6.
  3. Plastic Mop-Service Basins: ANSI Z124.6.
  4. Porcelain-Enameled, Formed-Steel Fixtures: ASME A112.19.4M.
  5. Stainless-Steel Fixtures Other Than Service Sinks: ASME A112.19.3M.
  6. Vitreous-China Fixtures: ASME A112.19.2M.
  7. Water-Closet, Flush Valve, Tank Trim: ASME A112.19.5.
- I. Comply with the following applicable standards and other requirements specified for lavatory and sink faucets:
  1. Backflow Protection Devices for Faucets with Hose-Thread Outlet: ASME A112.18.3M.
  2. Diverter Valves for Faucets with Hose Spray: ASSE 1025.
  3. Faucet Hose: ASTM D 3901.
  4. Faucets: ASME A112.18.1M.
  5. Hose-Connection Vacuum Breakers: ASSE 1011.
  6. Hose-Coupling Threads: ASME B1.20.7.
  7. NSF Materials: NSF 61.
  8. Pipe Threads: ASME B1.20.1.
  9. Supply and Drain Fittings: ASME A112.18.1M.

- J. Comply with the following applicable standards and other requirements specified for shower faucets:
  - 1. Backflow Protection Devices for Hand-Held Showers: ASME A112.18.3M.
  - 2. Combination, Pressure-Equalizing and Thermostatic-Control Antiscald Faucets: ASSE 1016.
  - 3. Faucets: ASME A112.18.1M.
  - 4. Manual-Control Antiscald Faucets: ASTM F 444.
  - 5. Pipe Threads: ASME B1.20.1.
  - 6. Pressure-Equalizing-Control Antiscald Faucets: ASTM F 444 and ASSE 1016.
- K. Comply with the following applicable standards and other requirements specified for miscellaneous fittings:
  - 1. Atmospheric Vacuum Breakers: ASSE 1001.
  - 2. Brass and Copper Supplies: ASME A112.18.1M.
  - 3. Manual-Operation Flushometers: ASSE 1037.
  - 4. Plastic Tubular Fittings and Piping: ASTM F 409.
  - 5. Tubular Brass Drainage Fittings and Piping: ASME A112.18.1M.
- L. Comply with the following applicable standards and other requirements specified for miscellaneous components:
  - 1. Disposers: ASSE 1008 and UL 430.
  - 2. Floor Drains: ASME A112.21.1M.
  - 3. Grab Bars: ASTM F 446.
  - 4. Hose-Coupling Threads: ASME B1.20.7.
  - 5. Off-Floor Fixture Supports: ASME A112.6.1M.
  - 6. Pipe Threads: ASME B1.20.1.
  - 7. Plastic Toilet Seats: ANSI Z124.5.
  - 8. Supply and Drain Protective Shielding Guards: ICC A117.1.

#### 1.6 COORDINATION

- A. Coordinate roughing-in and final plumbing fixture locations, and verify that fixtures can be installed to comply with original design and referenced standards.
- B. EXTRA MATERIALS
- C. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.
  - 2. Faucet, Flow-Control Fittings: Equal to 10 percent of amount of each type and size installed.
  - 3. Flushometer Valve, Repair Kits: Equal to 10 percent of amount of each type installed, but not less than 12 of each type.

4. Provide hinged-top wood or metal box, or individual metal boxes, with separate compartments for each type and size of extra materials listed above.
5. Flushometer Tank, Repair Kits: Equal to 5 percent of amount of each type installed, but not less than 2 of each type.
6. Water-Closet Tank, Repair Kits: Equal to 5 percent of amount of each type installed.
7. Toilet Seats: Equal to 5 percent of amount of each type installed.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Reference Plumbing Fixture Schedule on drawings for fixtures and fittings.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in for water soil and for waste piping systems and supports to verify actual locations and sizes of piping connections and that locations and types of supports match those indicated, before plumbing fixture installation. Use manufacturer's roughing-in data if roughing-in data are not indicated.
- B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 FIXTURE INSTALLATION

- A. Assemble fixtures, trim, fittings, and other components according to manufacturers' written instructions.
- B. For wall-hanging fixtures, install off-floor supports affixed to building substrate.
  1. Use carrier supports without waste fitting for fixtures with tubular waste piping.
- C. Install floor-mounting fixtures on closet flanges or other attachments to piping or building substrate.
- D. Install wall-hanging fixtures with tubular waste piping attached to supports.
- E. Install counter-mounting fixtures in and attached to casework.
- F. Install fixtures level and plumb according to manufacturers' written instructions and roughing-in drawings.

- G. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.
- H. Install trap and tubular waste piping on drain outlet of each fixture to be directly connected to sanitary drainage system.
- I. Install flushometer valves for urinals with handle mounted on wide side of compartment. Install other actuators in locations that are easy for people with disabilities to reach.
- J. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.
- K. Install toilet seats on water closets.
- L. Install faucet-spout fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.
- M. Deliver any specified undercounter lavatory template to counter manufacturer for correct opening.
- N. Install traps on fixture outlets.
  - 1. Exception: Omit trap on fixtures with integral traps.
  - 2. Exception: Omit trap on indirect wastes, unless otherwise indicated.
- O. Install disposer in outlet of sinks indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.
- P. Install escutcheons at piping wall ceiling penetrations in exposed, finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding fittings. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for escutcheons.
- Q. Seal joints between fixtures and walls, floors, and counters using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Refer to Division 7 Section "Joint Sealants" for sealant and installation requirements.

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect water supplies from water distribution piping to fixtures (with stops).
- C. Connect drain piping from fixtures to drainage piping.

- D. Supply and Waste Connections to Plumbing Fixtures: Connect fixtures with water supplies, stops, risers, traps, and waste piping. Use size fittings required to match fixtures. Connect to plumbing piping.
- E. Supply and Waste Connections to Fixtures and Equipment Specified in Other Sections: Connect fixtures and equipment with water supplies, stops, risers, traps, and waste piping specified. Use size fittings required to match fixtures and equipment. Connect to plumbing piping.
- F. Ground equipment.
  - 1. 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.

### 3.4 FIELD QUALITY CONTROL

- A. Verify that installed fixtures are categories and types specified for locations where installed.
- B. Check that fixtures are complete with trim, faucets, fittings, and other specified components.
- C. Inspect installed fixtures for damage. Replace damaged fixtures and components.
- D. Test installed fixtures after water systems are pressurized for proper operation. Replace malfunctioning fixtures and components, then retest. Repeat procedure until units operate properly.

### 3.5 ADJUSTING

- A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Operate and adjust disposers. Replace damaged and malfunctioning units.
- C. Adjust water pressure at faucets, shower valves, closet tanks, and flushometer valves to produce proper flow and stream.
- D. Replace cartridges of leaking and dripping faucets and stops.

### 3.6 CLEANING

- A. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials. Do the following:
  - 1. Remove faucet spouts and strainers, remove sediment and debris, and reinstall strainers and spouts.
  - 2. Remove sediment and debris from drains.

3.7 PROTECTION

- A. Provide protective covering for installed fixtures and fittings.
- B. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

**END OF SECTION 224200**

## **SECTION 230593 - TESTING, ADJUSTING, AND BALANCING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section includes testing, adjusting, and balancing Ventilation systems to produce design objectives, including the following:
  - 1. Balancing airflow within distribution systems, , Fans to indicated quantities according to specified tolerances.
  - 2. Adjusting total fan systems to provide indicated quantities.
  - 3. Measuring electrical performance of Ventilation equipment.
  - 4. Measuring sound and vibration.
  - 5. Reporting results of the activities and procedures specified in this Section.
- B. Related Sections include the following:
  - 1. Testing and adjusting requirements unique to particular systems and equipment are included in the Sections that specify those systems and equipment.
  - 2. Field quality-control testing to verify that workmanship quality for system and equipment installation is specified in system and equipment Sections.

#### **1.3 DEFINITIONS**

- A. Adjust: To regulate patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.
- B. Balance: To proportion flows within the distribution system, including submains, branches, and terminals, according to design quantities.
- C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.
- D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.
- E. Report Forms: Test data sheets for recording test data in logical order.

- F. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
- G. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.
- H. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.
- I. Test: A procedure to determine quantitative performance of a system or equipment.
- J. Testing, Adjusting, and Balancing Agent: The entity responsible for performing and reporting the testing, adjusting, and balancing procedures.
- K. AABC: Associated Air Balance Council.
- L. AMCA: Air Movement and Control Association.  
.
- M. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

#### 1.4 SUBMITTALS

- A. Quality-Assurance Submittals: Within 30 days from the Contractor's Notice to Proceed, submit 2 copies of evidence that the testing, adjusting, and balancing Agent and this Project's testing, adjusting, and balancing team members meet the qualifications specified in the "Quality Assurance" Article below.
- B. Contract Documents Examination Report: Within 45 days from the Contractor's Notice to Proceed, submit 2 copies of the Contract Documents review report as specified in Part 3 of this Section.
- C. Strategies and Procedures Plan: Within 60 days from the Contractor's Notice to Proceed, submit 2 copies of the testing, adjusting, and balancing strategies and step-by-step procedures as specified in Part 3 "Preparation" Article below. Include a complete set of report forms intended for use on this Project.
- D. Certified Testing, Adjusting, and Balancing Reports: Submit 2 copies of reports prepared, as specified in this Section, on approved forms certified by the testing, adjusting, and balancing Agent.
- E. Sample Report Forms: Submit 2 sets of sample testing, adjusting, and balancing report forms.
- F. Warranty: Submit 2 copies of special warranty specified in the "Warranty" Article below.

#### 1.5 QUALITY ASSURANCE



- A. Agent Qualifications: Engage a testing, adjusting, and balancing agent certified by AABC.
- B. Agent Qualifications: Engage a testing, adjusting, and balancing agent certified by NEBB.
- C. Agent Qualifications: Engage a testing, adjusting, and balancing agent certified by either AABC or NEBB.
- D. Testing, Adjusting, and Balancing Conference: Meet with the Owner's and the Architect's representatives on approval of the testing, adjusting, and balancing strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of testing, adjusting, and balancing team members, equipment manufacturers' authorized service representatives, HVAC controls Installer, and other support personnel. Provide 7 days' advance notice of scheduled meeting time and location.
  - 1. Agenda Items: Include at least the following:
    - a. Submittal distribution requirements.
    - b. Contract Documents examination report.
    - c. Testing, adjusting, and balancing plan.
    - d. Work schedule and Project site access requirements.
    - e. Coordination and cooperation of trades and subcontractors.
    - f. Coordination of documentation and communication flow.
- E. Certification of Testing, Adjusting, and Balancing Reports: Certify the testing, adjusting, and balancing field data reports. This certification includes the following:
  - 1. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.
  - 2. Certify that the testing, adjusting, and balancing team complied with the approved testing, adjusting, and balancing plan and the procedures specified and referenced in this Specification.
- F. Testing, Adjusting, and Balancing Reports: Use standard forms from AABC's "National Standards for Testing, Adjusting, and Balancing."
- G. Testing, Adjusting, and Balancing Reports: Use standard forms from NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."
- H. Testing, Adjusting, and Balancing Reports: Use standard forms from SMACNA's "HVAC Systems--Testing, Adjusting, and Balancing."
- I. Instrumentation Type, Quantity, and Accuracy: As described in AABC national standards.
- J. Instrumentation Type, Quantity, and Accuracy: As described in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems," Section II, "Required Instrumentation for NEBB Certification."
- K. Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

1.6 PROJECT CONDITIONS

- A. Partial Owner Occupancy: The Owner may occupy completed areas of the building before Substantial Completion. Cooperate with the Owner during testing, adjusting, and balancing operations to minimize conflicts with the Owner's operations.

1.7 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, fan controls installers, and other mechanics to operate Fan systems and equipment to support and assist testing, adjusting, and balancing activities.
- B. Notice: Provide 7 days' advance notice for each test. Include scheduled test dates and times.
- C. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.8 WARRANTY

- A. General Warranty: The national project performance guarantee specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. National Project Performance Guarantee: Provide a guarantee on AABC'S "National Standards" forms stating that AABC will assist in completing the requirements of the Contract Documents if the testing, adjusting, and balancing Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:
- C. Special Guarantee: Provide a guarantee on NEBB forms stating that NEBB will assist in completing the requirements of the Contract Documents if the testing, adjusting, and balancing Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:
  - 1. The certified Agent has tested and balanced systems according to the Contract Documents.
  - 2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.
  - 1. Contract Documents are defined in the General and Supplementary Conditions of the Contract.
  - 2. Verify that balancing devices, such as test ports, control devices, balancing valves and fittings, and manual volume dampers, are required by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- B. Examine approved submittal data of Ventilation systems and equipment.
- C. Examine project record documents described in Division 1 Section "Project Record Documents."
- D. Examine Architect's and Engineer's design data, including Ventilation system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about Ventilation system and equipment controls.
- E. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.
- F. Examine system and equipment test reports.
- G. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- H. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- I. Examine plenum ceilings, utilized for supply air, to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.
  - 1. Dampers are in the position indicated by the controller.
  - 2. Integrity of dampers for free and full operation and for tightness of fully closed and fully open positions. Controls are located to avoid adverse effects of sunlight, drafts, and cold walls.
  - 3. Sensors are located to sense only the intended conditions.
  - 4. Sequence of operation for control modes is according to the Contract Documents.
  - 5. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
  - 6. Interlocked systems are operating.
- J. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

### 3.2 PREPARATION

- A. Prepare a testing, adjusting, and balancing plan that includes strategies and step-by-step procedures.
- B. Complete system readiness checks and prepare system readiness reports. Verify the following:
  - 1. Permanent electrical power wiring is complete.
  - 2. Equipment and duct access doors are securely closed.
  - 3. Balance, smoke, and fire dampers are open.
  - 4. Isolating and balancing valves are open and control valves are operational.
  - 5. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
  - 6. Windows and doors can be closed so design conditions for system operations can be met.

### 3.3 GENERAL TESTING AND BALANCING PROCEDURES

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC national standards and this Section.
- B. Perform testing and balancing procedures on each system according to the procedures contained in NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.
- C. Perform testing and balancing procedures on each system according to the procedures contained in SMACNA's "HVAC Systems--Testing, Adjusting, and Balancing" and this Section.
- D. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to the insulation Specifications for this Project.
- E. Mark equipment settings with paint or other suitable, permanent identification material, including damper-control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

### 3.4 FUNDAMENTAL AIR SYSTEMS' BALANCING PROCEDURES

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.

- C. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- D. Check the airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.
- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air-handling unit components.
- K. Adjust volume dampers for main duct, submain ducts, and major branch ducts to design airflows within specified tolerances.
  - 1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
    - a. Where sufficient space in submains and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
- L. Adjust terminal outlets and inlets for each space to design airflows within specified tolerances of design values. Make adjustments using volume dampers rather than extractors and the dampers at the air terminals.
  - 1. Adjust each outlet in the same room or space to within specified tolerances of design quantities without generating noise levels above the limitations prescribed by the Contract Documents.
  - 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

### 3.5 MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
  - 1. Manufacturer, model, and serial numbers.
  - 2. Motor horsepower rating.
  - 3. Motor rpm.
  - 4. Efficiency rating if high-efficiency motor.
  - 5. Nameplate and measured voltage, each phase.
  - 6. Nameplate and measured amperage, each phase.
  - 7. Starter thermal-protection-element rating.

- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

### 3.6 TEMPERATURE TESTING

- A. During testing, adjusting, and balancing, report need for adjustment in temperature regulation within the automatic temperature-control system.
- B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of 2 successive 8-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.
- C. .
- D. Verify sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water-flow measurements. Note the speed of response to input changes.
- E. Confirm interaction of electrically operated switch transducers.
- F. Confirm interaction of interlock and lockout systems.
- G. Verify main control supply-air pressure and observe compressor and dryer operations.
- H. Record voltages of power supply and controller output. Determine if the system operates on a grounded or nongrounded power supply.
- I. Note operation of electric actuators using spring return for proper fail-safe operations.

### 3.7 TOLERANCES

- A. Set HVAC system airflow and water flow rates within the following tolerances:
  - 1. Supply, Return, and Exhaust Fans: Plus 5 to plus 10 percent.
  - 2. Air Outlets and Inlets: 0 to minus 10 percent.

### 3.8 REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article above, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

- B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

### 3.9 FINAL REPORT

- A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in 3-ring binder, tabulated and divided into sections by tested and balanced systems.
- B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
  - 1. Include a list of the instruments used for procedures, along with proof of calibration.
- C. Final Report Contents: In addition to the certified field report data, include the following:
  - 1. Fan curves.
  - 2. Manufacturers' test data.
  - 3. Field test reports prepared by system and equipment installers.
  - 4. Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.
- D. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:
  - 1. Title page.
  - 2. Name and address of testing, adjusting, and balancing Agent.
  - 3. Project name.
  - 4. Project location.
  - 5. Architect's name and address.
  - 6. Engineer's name and address.
  - 7. Contractor's name and address.
  - 8. Report date.
  - 9. Signature of testing, adjusting, and balancing Agent who certifies the report.
  - 10. Summary of contents, including the following:
    - a. Design versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.
  - 11. Nomenclature sheets for each item of equipment.
  - 12. Data for terminal units, including manufacturer, type size, and fittings.
  - 13. Notes to explain why certain final data in the body of reports vary from design values.
  - 14. Test conditions for fan performance forms, including the following:
    - a. Settings for outside-, return-, and exhaust-air dampers.

- b. Conditions of filters.
  - c. Cooling coil, wet- and dry-bulb conditions.
  - d. Fan drive settings, including settings and percentage of maximum pitch diameter.
  - e. Other system operating conditions that affect performance.
- E. System Diagrams: Include schematic layouts of air distribution systems. Present with single-line diagrams and include the following:
  - 1. Quantities of outside, supply, return, and exhaust airflows.
  - 2. Duct, outlet, and inlet sizes.
  - 3. Motor Data: Include the following:
    - a. Make and frame type and size.
    - b. Horsepower and rpm.
    - c. Volts, phase, and hertz.
    - d. Full-load amperage and service factor.
    - e. Sheave make, size in inches, and bore.
    - f. Sheave dimensions, center-to-center and amount of adjustments in inches.
  - 4. Test Data: Include design and actual values for the following:
    - a. Total airflow rate in cfm.
    - b. Total system static pressure in inches wg.
    - c. Fan rpm.
    - d. Discharge static pressure in inches wg.
    - e. Filter static-pressure differential in inches wg.
    - f. Cooling coil static-pressure differential in inches wg.
    - g. Heating coil static-pressure differential in inches wg.
    - h. Outside airflow in cfm.
    - i. Return airflow in cfm.
    - j. Outside-air damper position.
    - k. Return-air damper position.

### 3.10 ADDITIONAL TESTS

- A. Within 90 days of completing testing, adjusting, and balancing, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial testing, adjusting, and balancing procedures were not performed during near-peak summer and winter conditions, perform additional inspections, testing, and adjusting during near-peak summer and winter conditions.

### END OF SECTION 230593





## **SECTION 230713 - DUCT INSULATION**

### **PART 1 - GENERAL**

- 1.1 This specification would apply where HVAC units are replaced on roof and insulation is in need of repair or disturbed
- 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. This Section includes semirigid and flexible duct, plenum, insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.
  - B. All exposed spiral shall be double wall , concealed ductwork shall be wrapped with 1.5" f/g wrap
  - C. All ductwork exposed on roof shall be 2" fiber glass with w/p jacket
- 1.4 SUBMITTALS
  - A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.
  - B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.
  - C. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.
- 1.5 QUALITY ASSURANCE
  - A. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.
    - 1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.

2. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

#### 1.7 COORDINATION

- A. Coordinate clearance requirements with duct Installer for insulation application.

#### 1.8 SCHEDULING

- A. Schedule insulation application after testing duct systems. Insulation application may begin on segments of ducts that have satisfactory test results.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Mineral-Fiber Insulation:
    - a. CertainTeed Manson.
    - b. Knauf FiberGlass GmbH.
    - c. Owens-Corning Fiberglas Corp.
  2. Flexible Elastomeric Thermal Insulation:
    - a. Armstrong World Industries, Inc.
    - b. Rubatex Corp.

#### 2.2 INSULATION MATERIALS

- A. Mineral-Fiber Blanket Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.
- B. Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type II for sheet materials.
  1. Adhesive: As recommended by insulation material manufacturer.

2. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.
- C. Closed-Cell Phenolic-Foam Insulation: Block insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type II, Grade 1.

## 2.3 FIELD-APPLIED JACKETS

- A. General: ASTM C 921, Type 1, unless otherwise indicated.
- B. Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.
- C. PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils thick; roll stock ready for shop or field cutting and forming.
  1. Adhesive: As recommended by insulation material manufacturer.
  2. PVC Jacket Color: White or gray.
  3. PVC Jacket Color: Custom color selected by the Architect.
- D. Aluminum Jacket: Deep corrugated sheets manufactured from aluminum alloy complying with ASTM B 209, and having an integrally bonded moisture barrier over entire surface in contact with insulation. Metal thickness and corrugation dimensions are scheduled at the end of this Section.
  1. Finish: Smooth finish.
  2. Finish: Cross-crimp corrugated finish.
  3. Finish: Stucco-embossed finish.
  4. Finish: Factory-painted finish.
  5. Moisture Barrier: 1-mil- thick, heat-bonded polyethylene and kraft paper.

## 2.4 ACCESSORIES AND ATTACHMENTS

- A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd..
  1. Tape Width: 4 inches.
- B. Bands: 3/4 inch wide, in one of the following materials compatible with jacket:
  1. Stainless Steel: ASTM A 666, Type 304; 0.020 inch thick.
  2. Galvanized Steel: 0.005 inch thick.
  3. Aluminum: 0.007 inch thick.
  4. Brass: 0.010 inch thick.
  5. Nickel-Copper Alloy: 0.005 inch thick.
- C. Weld-Attached Anchor Pins and Washers: Copper-coated steel pin for capacitor-discharge welding and galvanized speed washer. Pin length sufficient for insulation thickness indicated.

1. Welded Pin Holding Capacity: 100 lb for direct pull perpendicular to the attached surface.
- D. Adhesive-Attached Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.
  1. Adhesive: Recommended by the anchor pin manufacturer as appropriate for surface temperatures of ducts, plenums, and breechings; and to achieve a holding capacity of 100 lb for direct pull perpendicular to the adhered surface.
- E. Self-Adhesive Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.

## 2.5 VAPOR RETARDERS

- A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

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

### 3.3 GENERAL APPLICATION REQUIREMENTS

- A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of ducts and fittings.

- B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each duct system.
- C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Apply multiple layers of insulation with longitudinal and end seams staggered.
- E. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
- F. Keep insulation materials dry during application and finishing.
- G. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
- H. Apply insulation with the least number of joints practical.
- I. Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
- J. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.
- K. Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
- L. Apply insulation with integral jackets as follows:
  - 1. Pull jacket tight and smooth.
  - 2. Joints and Seams: Cover with tape and vapor retarder as recommended by insulation material manufacturer to maintain vapor seal.
  - 3. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- M. Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.
- N. Install vapor-retarder mastic on ducts and plenums scheduled to receive vapor retarders.
  - 1. Ducts with Vapor Retarders: Overlap insulation facing at seams and seal with vapor-retarder mastic and pressure-sensitive tape having same facing as insulation. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-retarder seal.
  - 2. Ducts without Vapor Retarders: Overlap insulation facing at seams and secure with outward clinching staples and pressure-sensitive tape having same facing as insulation.

- O. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.
  - 1. Seal penetrations with vapor-retarder mastic.
  - 2. Apply insulation for exterior applications tightly joined to interior insulation ends.
  - 3. Seal insulation to roof flashing with vapor-retarder mastic.
- P. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.
- Q. Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire/smoke damper sleeves for fire-rated wall and partition penetrations.
- R. Floor Penetrations: Terminate insulation at underside of floor assembly and at floor support at top of floor.
  - 1. For insulation indicated to have vapor retarders, taper termination and seal insulation ends with vapor-retarder mastic.

### 3.4 MINERAL-FIBER INSULATION APPLICATION

- A. Blanket Applications for Ducts and Plenums: Secure blanket insulation with adhesive and anchor pins and speed washers.
  - 1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct and plenum surfaces.
  - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  - 3. Install anchor pins and speed washers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides with dimensions 18 inches and smaller, along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches. Space 16 inches o.c. each way, and 3 inches maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
    - c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not overcompress insulation during installation.
  - 4. Impale insulation over anchors and attach speed washers.
  - 5. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  - 6. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent

- insulation segment with 1/2-inch staples, 1 inch o.c., and cover with pressure-sensitive tape having same facing as insulation.
7. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. Secure with steel band at end joints and spaced a maximum of 18 inches o.c.
  8. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
  9. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch- wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches o.c.
  10. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.
- B. Board Applications for Ducts and Plenums: Secure board insulation with adhesive and anchor pins and speed washers.
1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct and plenum surfaces.
  2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  3. Space anchor pins as follows:
    - a. On duct sides with dimensions 18 inches and smaller, along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches. Space 16 inches o.c. each way, and 3 inches maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
    - c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not overcompress insulation during installation.
  4. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  5. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch staples, 1 inch o.c., and cover with pressure-sensitive tape having same facing as insulation.
  6. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
  7. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch- wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches o.c.
  8. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.



### 3.5 FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION

- A. Apply insulation to ducts and plenums as follows:
  - 1. Follow the manufacturer's written instructions for applying insulation.
  - 2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the duct and plenum surface.

### 3.6 FINISHES

- A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

### 3.7 DUCT SYSTEM APPLICATIONS

- A. Insulation materials and thicknesses are specified in schedules at the end of this Section.
- B. Materials and thicknesses for systems listed below are specified in schedules at the end of this Section.
- C. Insulate the following plenums and duct systems:
  - 1. Indoor concealed supply-, return-, and outside-air ductwork.
  - 2. Indoor exposed supply-, return-, and outside-air ductwork.
  - 3. Outdoor exposed supply and return ductwork.
- D. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:
  - 1. Fibrous-glass ducts.
  - 2. Metal ducts with duct liner.
  - 3. Factory-insulated flexible ducts.
  - 4. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
  - 5. Flexible connectors.
  - 6. Vibration-control devices.
  - 7. Testing agency labels and stamps.
  - 8. Nameplates and data plates.
  - 9. Access panels and doors in air-distribution systems.

### 3.8 INDOOR DUCT AND PLENUM APPLICATION SCHEDULE

- A. Service: Round, supply-air ducts, concealed

1. Material: Mineral-fiber blanket.
  2. Thickness: 1-1/2 inches.
  3. Number of Layers: One.
  4. Field-Applied Jacket: Foil and paper.
  5. Vapor Retarder Required: No.
- B. Service: Round, return-air ducts, concealed.
1. Material: none
- C. Service: Rectangular, supply-air ducts, concealed.
1. Material: Mineral-fiber blanket.
  2. Thickness: 1-1/2 inch.
  3. Number of Layers: One.
  4. Vapor Retarder Required: No.
- D. Service: Rectangular, return-air ducts, concealed.
1. Material: None
- E. Service: Round, supply-air ducts, exposed (spiral duct shall have liner with 1” insul).
1. Material: double wall
  2. Thickness: 1”
  3. Number of Layers: One.
  4. Field-Applied Jacket: n/a
  5. Vapor Retarder Required: No.
- F. Service: Rectangular, supply-air ducts, exposed.
1. Material: Mineral-fiber board liner.
  2. Thickness: 1/2 inch.
  3. Number of Layers: One.
  4. Vapor Retarder Required: No.
- G. Service: Rectangular, outside-air ducts, exposed.
1. Material: Mineral-fiber blanket. Waterproof jacket
  2. Thickness: 2 inches.
  3. Number of Layers: One.
  4. Vapor Retarder Required: Yes.

**END OF SECTION 230713**



## **SECTION 230719 - PIPE INSULATION**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section includes preformed, rigid and flexible pipe insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.
- B. Related Sections include the following:
  - 1. Division 230713 Section "Duct Insulation" for insulation for ducts and plenums.

#### **1.3 SUBMITTALS**

- A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for the following:
  - 1. Application of protective shields, saddles, and inserts at pipe hangers for each type of insulation and hanger.
  - 2. Attachment and covering of heat trace inside insulation.
  - 3. Insulation application at pipe expansion joints for each type of insulation.
  - 4. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  - 5. Removable insulation at piping specialties and equipment connections.
  - 6. Application of field-applied jackets.
- C. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.
- D. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

#### **1.4 QUALITY ASSURANCE**

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.
  - 1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread rating of 75 or less, and smoke-developed rating of 150 or less.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

#### 1.6 COORDINATION

- A. Coordinate clearance requirements with piping Installer for insulation application.

#### 1.7 SCHEDULING

- A. Schedule insulation application after testing piping systems and, where required, after installing and testing heat-trace tape. Insulation application may begin on segments of piping that have satisfactory test results.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Flexible Elastomeric Thermal Insulation:
    - a. Armstrong World Industries, Inc.
    - b. Rubatex Corp.

- 2. Polyolefin Insulation:
  - a. Armstrong World Industries, Inc.
  - b. IMCOA.
- 3. Closed-Cell Phenolic-Foam Insulation:
  - a. Kooltherm Insulation Products, Ltd.

## 2.2 INSULATION MATERIALS

## 2.3 FIELD-APPLIED JACKETS

- A. General: ASTM C 921, Type 1, unless otherwise indicated.
- B. all purpose Jacket: Laminated, glass-fiber-reinforced, flame-retardant

## 2.4 ACCESSORIES AND ATTACHMENTS

- A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, pre-sized a minimum of 8 oz./sq. yd. (270 g/sq. m).
  - 1. Tape Width: 4 inches (100 mm).
- B. Bands: 3/4 inch (19 mm) wide, in one of the following materials compatible with jacket:
  - 1. Stainless Steel: ASTM A 666, Type 304; 0.020 inch (0.5 mm) thick.
  - 2. Galvanized Steel: 0.005 inch (0.13 mm) thick.
  - 3. Aluminum: 0.007 inch (0.18 mm) thick.
  - 4. Brass: 0.010 inch (0.25 mm) thick.
  - 5. Nickel-Copper Alloy: 0.005 inch (0.13 mm) thick.
- C. Wire: 0.080-inch (2.0-mm), nickel-copper alloy; 0.062-inch (1.6-mm), soft-annealed, stainless steel; or 0.062-inch (1.6-mm), soft-annealed, galvanized steel.

## 2.5 VAPOR RETARDERS

- A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

# PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

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

### 3.3 GENERAL APPLICATION REQUIREMENTS

- A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.
- B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.
- C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.
- E. Apply multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
- H. Keep insulation materials dry during application and finishing.
- I. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
- J. Apply insulation with the least number of joints practical.
- K. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.
- L. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.
  - 1. Apply insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches (300 mm) from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
  3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
  4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.
- M. Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
- N. Apply adhesives and mastics at the manufacturer's recommended coverage rate.
- O. Apply insulation with integral jackets as follows:
1. Pull jacket tight and smooth.
  2. Circumferential Joints: Cover with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches (100 mm) o.c.
  3. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches (40 mm). Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (100 mm) o.c.
    - a. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.
  4. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
  5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.
- P. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.
1. Seal penetrations with vapor-retarder mastic.
  2. Apply insulation for exterior applications tightly joined to interior insulation ends.
  3. Extend metal jacket of exterior insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
  4. Seal metal jacket to roof flashing with vapor-retarder mastic.
- Q. Exterior Wall Penetrations: For penetrations of below-grade exterior walls, terminate insulation flush with mechanical sleeve seal. Seal terminations with vapor-retarder mastic.
- R. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.



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### 3.4 FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION

- A. Apply insulation to straight pipes and tubes as follows:
  1. Follow manufacturer's written instructions for applying insulation.
  2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.
- B. Apply insulation to flanges as follows:
  1. Apply pipe insulation to outer diameter of pipe flange.
  2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
  3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of the same thickness as pipe insulation.
  4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.
- C. Apply insulation to fittings and elbows as follows:
  1. Apply mitered sections of pipe insulation.
  2. Secure insulation materials and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.
- D. Apply insulation to valves and specialties as follows:
  1. Apply preformed valve covers manufactured of the same material as pipe insulation and attached according to the manufacturer's written instructions.
  2. Apply cut segments of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, fabricate removable sections of insulation arranged to allow access to strainer basket.
  3. Apply insulation to flanges as specified for flange insulation application.
  4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

### 3.5 CLOSED-CELL PHENOLIC-FOAM INSULATION APPLICATION

- A. Apply insulation to straight pipes and tubes as follows:

1. Secure each layer of insulation to pipe with wire, tape, or bands without deforming insulation materials.
  2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic.
  3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
  4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.
- B. Apply insulation to flanges as follows:
1. Apply preformed pipe insulation to outer diameter of pipe flange.
  2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
  3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of block insulation of the same material and thickness as pipe insulation.
  4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch (25 mm), and seal joints with vapor-retarder mastic.
- C. Apply insulation to fittings and elbows as follows:
1. Apply pre-molded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
  2. When pre-molded sections of insulation are not available, apply mitered sections of phenolic-foam insulation. Secure insulation materials with wire, tape, or bands.
  3. Cover fittings with standard PVC fitting covers.
  4. Cover fittings with heavy PVC fitting covers. Overlap PVC covers on pipe insulation jackets at least 1 inch (25 mm) at each end. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
- D. Apply insulation to valves and specialties as follows:
1. Apply pre-molded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
  2. When pre-molded sections of insulation are not available, apply mitered segments of phenolic-foam insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to strainer basket without disturbing insulation.
  3. Apply insulation to flanges as specified for flange insulation application.
  4. Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.
  5. Use preformed heavy PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

6. For larger sizes where PVC fitting covers are not available, seal insulation with canvas jacket and sealing compound recommended by the insulation material manufacturer.
7. Apply insulation to flanges as specified for flange insulation application.
8. Finish valve and specialty insulation the same as pipe insulation.

### 3.6 FIELD-APPLIED JACKET APPLICATION

- A. Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.
  1. Apply jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
  2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of jacket manufacturer's recommended adhesive.
  3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.
- B. Foil and Paper Jackets: Apply foil and paper jackets where indicated.
  1. Draw jacket material smooth and tight.
  2. Apply lap or joint strips with the same material as jacket.
  3. Secure jacket to insulation with manufacturer's recommended adhesive.
  4. Apply jackets with 1-1/2-inch (40-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
  5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-retarder mastic.

### 3.7 FINISHES

- A. Glass-Cloth Jacketed Insulation: Paint insulation finished with glass-cloth jacket as specified in Division 9 Section "Painting."
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of the insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

### 3.8 PIPING SYSTEM APPLICATIONS

- A. Insulation materials and thicknesses are specified in schedules at the end of this Section.
- B. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:
  1. Flexible connectors.
  2. Vibration-control devices.

3. Fire-suppression piping.
4. Drainage piping located in crawl spaces, unless otherwise indicated.
5. Below-grade piping, unless otherwise indicated.
6. Chrome-plated pipes and fittings, unless potential for personnel injury.
7. Air chambers, unions, strainers, check valves, plug valves, and flow regulators.

### 3.9 FIELD QUALITY CONTROL

- A. Inspection: Owner will engage a qualified inspection agency to perform the following field quality-control inspections, after installing insulation materials, jackets, and finishes, to determine compliance with requirements:
- B. Inspection: Engage a qualified inspection agency to perform the following field quality-control inspections, after installing insulation materials, jackets, and finishes, to determine compliance with requirements:
- C. Inspection: Perform the following field quality-control inspections, after installing insulation materials, jackets, and finishes, to determine compliance with requirements:
  1. Inspect fittings and valves randomly selected by Architect.
  2. Remove fitting covers from 20 elbows or 1 percent of elbows, whichever is less, for various pipe sizes.
  3. Remove fitting covers from 20 valves or 1 percent of valves, whichever is less, for various pipe sizes.
- D. Insulation applications will be considered defective if sample inspection reveals noncompliance with requirements. Remove defective Work and replace with new materials according to these Specifications.
- E. Reinstall insulation and covers on fittings and valves uncovered for inspection according to these Specifications.

### 3.10 INSULATION APPLICATION SCHEDULE, GENERAL

- A. Refer to insulation application schedules for required insulation materials, vapor retarders, and field-applied jackets.
- B. Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements.

### 3.11 INTERIOR INSULATION APPLICATION SCHEDULE

- A. Domestic cold water – ½” Armaflex
- B. Domestic Hot Water – ¾” Armaflex
- C. Condensate Lines – none required if using PVC. If Copper – ½” Elastomeric

3.12 EXTERIOR INSULATION APPLICATION SCHEDULE

- A. For underground supply piping, use product equal to Aquatherm “green pipe”.

## **SECTION 232300 - REFRIGERANT PIPING**

### **PART 1 - GENERAL**

#### **1.1 Specification is for Condensing Units relocated**

#### **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. This Section includes refrigerant piping used for air-conditioning applications.

#### **1.4 SUBMITTALS**

- A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for thermostatic expansion valves, solenoid valves, and pressure-regulating valves.
- B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationship between piping and equipment.
  - 1. Refrigerant piping indicated is schematic only. Size piping and design the actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes, to ensure proper operation and compliance with warranties of connected equipment.
- C. Welding Certificates: Copies of certificates for welding procedures and personnel.
- D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- E. Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals specified in Division 1.

#### **1.5 QUALITY ASSURANCE**

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX; "Welding and Brazing Qualifications."
- B. ASHRAE Standard: Comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."
- C. ASME Standard: Comply with ASME B31.5, "Refrigeration Piping."
- D. UL Standard: Provide products complying with UL 207, "Refrigerant-Containing Components and Accessories, Nonelectrical"; or UL 429, "Electrically Operated Valves."

1.6 COORDINATION

- A. Coordinate layout and installation of refrigerant piping and suspension system components with other construction, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.
- B. Coordinate pipe sleeve installations for wall penetrations.
- C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. Coordinate pipe sleeve installations for penetrations in exterior walls and floor assemblies. Coordinate with requirements for firestopping Coordinate pipe fitting pressure classes with products specified in related Sections.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Refrigerants:
    - a. Allied Signal, Inc./Fluorine Products; Genetron Refrigerants.
    - b. DuPont Company; Fluorochemicals Div.
    - c. Elf Atochem North America, Inc.; Fluorocarbon Div.
    - d. ICI Americas Inc./ICI KLEA; Fluorochemicals Bus.
  - 2. Refrigerant Valves and Specialties: By VFR manufacturer

2.2 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tube: **Type ACR]** Wrought-Copper Fittings: ASME B16.22.
- B. Wrought-Copper Unions: ASME B16.22.
- C. Bronze Filler Metals: AWS A5.8, Classification BAg-1 (silver)

2.3 REFRIGERANTS

- A. ASHRAE 34, R-410a:

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Aboveground, within Building: Type ACR soft drawn
- B. Install flexible connectors at or near compressors where piping configuration does not absorb vibration.

### 3.2 PIPING INSTALLATION

- A. Install refrigerant piping according to ASHRAE 15.
- B. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.
- C. Arrange piping to allow inspection and service of compressor and other equipment. Install valves and specialties in accessible locations to allow for service and inspection.
- D. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation.
- E. Belowground, install copper tubing in protective conduit. Vent conduit outdoors.
- F. Install copper tubing in rigid or flexible conduit in locations where copper tubing will be exposed to mechanical injury.
- G. Slope refrigerant piping as follows:
  - 1. Install horizontal suction lines with a uniform slope downward to compressor.
  - 2. Install traps and double risers to entrain oil in vertical runs.
  - 3. Liquid lines may be installed level.
- H. When brazing, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion valve bulb.
- I. Hanger, support, and anchor products are specified in Division 15 Section "Hangers and Supports."
- J. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet (6.0 m) long.
- K. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
  - 1. NPS 1/2 (DN 15): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
  - 2. NPS 5/8 (DN 18): Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm).
  - 3. NPS 1 (DN 25): Maximum span, 72 inches (1800 mm); minimum rod size, 1/4 inch (6.4 mm).

### 3.3 PIPE JOINT CONSTRUCTION

- A. Braze joints according to Division 15 Section "Basic Mechanical Materials and Methods."
- B. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide) during brazing to prevent scale formation.

### 3.4 FIELD QUALITY CONTROL

- A. Test and inspect refrigerant piping according to ASME B31.5, Chapter VI.
  - 1. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure.
  - 2. Test high- and low-pressure side piping of each system at not less than the lower of the design pressure or the setting of pressure relief device protecting high and low side of system.
    - a. System shall maintain test pressure at the manifold gage throughout duration of test.



- b. Test joints and fittings by brushing a small amount of soap and glycerine solution over joint.
- c. Fill system with nitrogen to raise a test pressure of 150 psig (1035 kPa) or higher as required by authorities having jurisdiction.
- d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

### 3.5 ADJUSTING

- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat requirements.
- B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set-point temperature of the conditioned air controllers to the system design temperature.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
  - 1. Check compressor oil level above center of sight glass.
  - 2. Open compressor suction and discharge valves.
  - 3. Open refrigerant valves, except bypass valves that are used for other purposes.
  - 4. Check compressor-motor alignment, and lubricate motors and bearings.

### 3.6 CLEANING

- A. Before installing copper tubing other than Type ACR, clean tubing and fittings with trichloroethylene.
- B. Replace core of filter-dryer after system has been adjusted and design flow rates and pressures are established.

### 3.7 SYSTEM CHARGING

- A. Charge system using the following procedures:
  - 1. Install core in filter-dryer after leak test but before evacuation.
  - 2. Evacuate entire refrigerant system with a vacuum pump to a vacuum of 500 micrometers (67 Pa). If vacuum holds for 12 hours, system is ready for charging.
  - 3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig (14 kPa).
  - 4. Charge system with a new filter-dryer core in charging line. Provide full-operating charge.

**END OF SECTION 232300**

## SECTION 233113 - METAL DUCTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes rectangular, round, and flat-oval metal ducts and plenums for heating, ventilating, and air-conditioning systems in pressure classes from minus 2- to plus 10-inch wg.

#### 1.3 DEFINITIONS

- A. Thermal Conductivity and Apparent Thermal Conductivity (k-Value): As defined in ASTM C 168. In this Section, these values are the result of the formula  $\text{Btu} \times \text{in./h} \times \text{sq. ft.} \times \text{deg F}$  or  $\text{W/m} \times \text{K}$  at the temperature differences specified. Values are expressed as Btu or W.

- 1. Example: Apparent Thermal Conductivity (k-Value): 0.26 or 0.037.

#### 1.4 SYSTEM DESCRIPTION

- A. Duct system design, as indicated, has been used to select and size air-moving and -distribution equipment and other components of air system. Changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.
- B. All duct sizing shown on drawings is free air path without required insulation. All exposed duct to be internally insulated and paint-ready. This includes DOAS duct in hallways and round duct serving classrooms. Any concealed duct may be wrapped.

#### 1.5 SUBMITTALS

- A. Product Data: For sealing materials.
- B. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:
  - 1. Ceiling suspension assembly members.
  - 2. Other systems installed in same space as ducts.
  - 3. Ceiling- and wall-mounted access doors and panels required to provide access to dampers and other operating devices.
  - 4. Coordination with ceiling-mounted items, including lighting fixtures, diffusers, grilles, speakers, sprinkler heads, access panels, and special moldings.
- C. Welding Certificates: Copies of certificates indicating welding procedures and personnel comply with requirements in "Quality Assurance" Article.

- D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- E. Record Drawings: Indicate actual routing, fitting details, reinforcement, support, and installed accessories and devices.

#### 1.6 QUALITY ASSURANCE

- A. Welding Standards: Qualify welding procedures and welding personnel to perform welding processes for this Project according to AWS D1.1, "Structural Welding Code--Steel," for hangers and supports; AWS D1.2, "Structural Welding Code--Aluminum," for aluminum supporting members; and AWS D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," unless otherwise indicated.
- C. Comply with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems," unless otherwise indicated.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver sealant and firestopping materials to site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle sealant and firestopping materials according to manufacturer's written recommendations.

### PART 2 - PRODUCTS

#### 2.1 SHEET METAL MATERIALS

- A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.
- B. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- C. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for 36-inch length or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

#### 2.2 SEALANT MATERIALS

- A. Joint and Seam Sealants, General: The term "sealant" is not limited to materials of adhesive or mastic nature but includes tapes and combinations of open-weave fabric strips and mastics.
  - 1. Joint and Seam Tape: 2 inches wide; glass-fiber fabric reinforced.
  - 2. Tape Sealing System: Woven-fiber tape impregnated with a gypsum mineral compound and a modified acrylic/silicone activator to react exothermically with tape to form a hard, durable, airtight seal.
  - 3. Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant, formulated with a minimum of 75 percent solids.
  - 4. Flanged Joint Mastics: One-part, acid-curing, silicone, elastomeric joint sealants, complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.

## 2.3 HANGERS AND SUPPORTS

- A. Building Attachments: Structural-steel fasteners appropriate for building materials.
- B. Hanger Materials: Galvanized, sheet steel or round, threaded steel rod.
  - 1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rod or galvanized rods with threads painted after installation.
  - 2. Straps and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for sheet steel width and thickness and for steel rod diameters.
- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- D. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.
  - 1. Supports for Galvanized-Steel Ducts: Galvanized steel shapes and plates.

## 2.4 RECTANGULAR DUCT FABRICATION

- A. General: Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction with galvanized, sheet steel, according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible." Comply with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
  - 1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure classification.
  - 2. Materials: Free from visual imperfections such as pitting, seam marks, roller marks, stains, and discolorations.
- B. Static-Pressure Classifications: Unless otherwise indicated, construct ducts to the following:
  - 1. Supply Ducts: 3-inch wg.
  - 2. Return Ducts: 2-inch wg, negative pressure.
  - 3. Exhaust Ducts: 2-inch wg, negative pressure.
- C. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of unbraced panel area, unless ducts are lined.

## 2.5 ROUND DUCT FABRICATION

- A. Round Ducts: Fabricate supply ducts of galvanized steel according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Concealed Round Ducts (except flex) shall be wrapped with 1-1/2" F/G wrap.

## 2.6 ROUND SUPPLY AND EXHAUST FITTING FABRICATION

- A. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal seam straight duct.
- B. Diverging-Flow Fittings: Fabricate with a reduced entrance to branch taps with no excess material projecting from body onto branch tap entrance.

- C. Elbows: Fabricate in die-formed, gored, pleated, or mitered construction. Fabricate bend radius of die-formed, gored, and pleated elbows one and one-half times elbow diameter. Unless elbow construction type is indicated, fabricate elbows as follows:
1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
  2. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg:
    - a. Ducts 3 to 26 Inches in Diameter: 0.028 inch.
  3. Round Mitered Elbows: Welded construction with the following metal thickness for pressure classes from 2- to 10-inch wg:
    - a. Ducts 3 to 14 Inches in Diameter: 0.028 inch.
    - b. Ducts 15 to 26 Inches in Diameter: 0.034 inch.
  4. 90-Degree, Two-Piece, Mitered Elbows: Use only for supply systems, or exhaust systems for material-handling classes A and B; and only where space restrictions do not permit using 1.5 bend radius elbows. Fabricate with single-thickness turning vanes.
  5. Round Elbows, 8 Inches and Smaller: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate nonstandard bend-angle configuration or nonstandard diameter elbows with gored construction.
  6. Round Elbows, 9 through 14 Inches: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees, unless space restrictions require a mitered elbow. Fabricate nonstandard bend-angle configuration or nonstandard diameter elbows with gored construction.
  7. Round Elbows, Larger Than 14 Inches: Fabricate gored elbows, unless space restrictions require a mitered elbow.
  8. Die-Formed Elbows for Sizes through 8 Inches and All Pressures: 0.040 inch thick with two-piece welded construction.
  9. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
  10. Pleated Elbows for Sizes through 14 Inches and Pressures through 10-Inch wg: 0.022 inch.

### PART 3 - EXECUTION

#### 3.1 DUCT INSTALLATION, GENERAL

- A. Duct installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts, fittings, and accessories.
- B. Construct and install each duct system for the specific duct pressure classification indicated.
- C. Install round ducts in lengths not less than 12 feet, unless interrupted by fittings.
- D. Install ducts with fewest possible joints.
- E. Install fabricated fittings for changes in directions, changes in size and shape, and connections.
- F. Install couplings tight to duct wall surface with a minimum of projections into duct.
- G. Install ducts, unless otherwise indicated, vertically and horizontally, parallel and perpendicular to building lines; avoid diagonal runs.

- H. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- I. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- J. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions, unless specifically indicated.
- K. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.
- L. Electrical Equipment Spaces: Route ductwork to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
- M. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same metal thickness as duct. Overlap opening on four sides by at least 1-1/2 inches.

### 3.2 SEAM AND JOINT SEALING

- A. General: Seal duct seams and joints according to the duct pressure class indicated and as described in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Pressure Classification Less Than 2-Inch wg: Transverse joints.
- C. Seal externally insulated ducts before insulation installation.

### 3.3 HANGING AND SUPPORTING

- A. Install rigid round, rectangular, with support systems indicated in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.
- C. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.

### 3.4 CONNECTIONS

- A. Connect equipment with flexible connectors according to Division 23 Section "Duct Accessories."
- B. For branch, outlet and inlet, and terminal unit connections, comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."

### 3.5 FIELD QUALITY CONTROL

- A. Disassemble, reassemble, and seal segments of systems as required to accommodate leakage testing and as required for compliance with test requirements.
- B. Conduct tests, in presence of Architect, at static pressures equal to maximum design pressure of system or section being tested. If pressure classifications are not indicated, test entire system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.

- C. Determine leakage from entire system or section of system by relating leakage to surface area of test section.
- D. Maximum Allowable Leakage: Comply with requirements for Leakage Classification 3 for round and flat-oval ducts, Leakage Classification 12 for rectangular ducts in pressure classifications less than and equal to 2-inch wg (both positive and negative pressures), and Leakage Classification 6 for pressure classifications from 2- to 10-inch wg.
- E. Remake leaking joints and retest until leakage is less than maximum allowable.
- F. Leakage Test: Perform tests according to SMACNA's "HVAC Air Duct Leakage Test Manual."

### 3.6 ADJUSTING

- A. Adjust volume-control dampers in ducts, outlets, and inlets to achieve design airflow.
- B. Refer to Section "Testing, Adjusting, and Balancing" for detailed procedures.

### 3.7 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect the system. Vacuum ducts before final acceptance to remove dust and debris.

**END OF SECTION 233113**

## SECTION 233300 - DUCT ACCESSORIES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Backdraft dampers.
  - 2. Manual-volume dampers.
  - 3. Fire and smoke dampers.
  - 4. Duct silencers.
  - 5. Turning vanes.
  - 6. Duct-mounted access doors and panels.
  - 7. Flexible ducts.
  - 8. Flexible connectors.
  - 9. Duct accessory hardware.

#### 1.3 SUBMITTALS

- A. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loadings, required clearances, method of field assembly, components, location, and size of each field connection. Detail the following:
  - 1. Special fittings and manual- and automatic-volume-damper installations.
  - 2. Fire- and smoke-damper installations, including sleeves and duct-mounted access doors and panels.
- B. Product Certificates: Submit certified test data on dynamic insertion loss; self-noise power levels; and airflow performance data, static-pressure loss, dimensions, and weights.

#### 1.4 QUALITY ASSURANCE

- A. NFPA Compliance: Comply with the following NFPA standards:
  - 1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
  - 2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

#### 1.5 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
  - 1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

### PART 2 - PRODUCTS



## 2.1 SHEET METAL MATERIALS

- A. Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M, G90 coating designation; mill-phosphatized finish for surfaces of ducts exposed to view.
- B. Carbon-Steel Sheets: ASTM A 366/A 366M, cold-rolled sheets, commercial quality, with oiled, exposed matte finish.
- C. Reinforcement Shapes and Plates: Galvanized steel reinforcement where installed on galvanized, sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for 36-inch length or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

## 2.2 BACKDRAFT DAMPERS

- A. Description: Suitable for horizontal or vertical installations.
- B. Frame: 0.052-inch- thick, galvanized, sheet steel, with welded corners and mounting flange.
- C. Frame: 0.052-inch- thick, galvanized, sheet steel, with welded corners.
- D. Blades: 0.025-inch- thick, roll-formed aluminum.
- E. Blades: 0.050-inch- thick aluminum sheet.
- F. Blade Seals: Neoprene.
- G. Blade Axles: Nonferrous.
- H. Tie Bars and Brackets: Galvanized steel.
- I. Return Spring: Adjustable tension.

## 2.3 MANUAL-VOLUME DAMPERS

- A. General: Factory fabricated with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.
  - 1. Pressure Classifications of 3-Inch wg or Higher: End bearings or other seals for ducts with axles full length of damper blades and bearings at both ends of operating shaft.
- B. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, with linkage outside airstream, and suitable for horizontal or vertical applications.
- C. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, and suitable for horizontal or vertical applications.
  - 1. Steel Frames: Hat-shaped, galvanized, sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
  - 2. Aluminum Frames: Hat-shaped, 0.10-inch- thick, aluminum sheet channels; frames with flanges where indicated for attaching to walls; and flangeless frames where indicated for installing in ducts.
  - 3. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized, sheet steel.
  - 4. Roll-Formed Aluminum Blades: 0.10-inch- thick aluminum sheet.
  - 5. Extruded-Aluminum Blades: 0.050-inch- thick extruded aluminum.

- 6. Blade Axles: Galvanized steel.
- 7. Tie Bars and Brackets: Aluminum.
- 8. Tie Bars and Brackets: Galvanized steel.

## 2.4 FIRE DAMPERS

- A. General: Labeled to UL 555.
- B. Fire Rating: One and one-half hours.
- C. Frame: SMACNA Type B with blades out of airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.
- D. Mounting Sleeve: Factory- or field-installed galvanized, sheet steel.
  - 1. Minimum Thickness: 0.052 inch or 0.138 inch thick as indicated, and length to suit application.
  - 2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.
- E. Mounting Orientation: Vertical or horizontal as indicated.
- F. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized, sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized steel blade connectors.
- G. Horizontal Dampers: Include a blade lock and stainless-steel negator closure spring.
- H. Fusible Link: Replaceable, 165 or 212 deg F rated as indicated.

## 2.5 CEILING FIRE DAMPERS

- A. General: Labeled to UL 555C; comply with construction details for tested floor- and roof-ceiling assemblies as indicated in UL's "Fire Resistance Directory."
- B. Frame: 0.040-inch- thick, galvanized, sheet steel; round or rectangular; style to suit ceiling construction.
- C. Blades: 0.034-inch- thick, galvanized, sheet steel with nonasbestos refractory insulation.
- D. Volume Adjustment: UL-labeled, fusible volume-control adjustment.
- E. Fusible Link: Replaceable, 165 deg F rated.

## 2.6 TURNING VANES

- A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Manufactured Turning Vanes: Fabricate of 1-1/2-inch- wide, curved blades set 3/4 inch o.c.; support with bars perpendicular to blades set 2 inches o.c.; and set into side strips suitable for mounting in ducts.
- C. Acoustic Turning Vanes: Fabricate of airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

2.7 DUCT-MOUNTED ACCESS DOORS AND PANELS

- A. General: Fabricate doors and panels airtight and suitable for duct pressure class.
- B. Frame: Galvanized, sheet steel, with bend-over tabs and foam gaskets.
- C. Door: Double-wall, galvanized, sheet metal construction with insulation fill and thickness, and number of hinges and locks as indicated for duct pressure class. Include vision panel where indicated. Include 1-by-1-inch butt or piano hinge and cam latches.
- D. Seal around frame attachment to duct and door to frame with neoprene or foam rubber.
- E. Insulation: 1-inch- thick, fibrous-glass or polystyrene-foam board.

2.8 FLEXIBLE CONNECTORS

- A. General: Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.
- B. Standard Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized, sheet steel or 0.032-inch aluminum sheets. Select metal compatible with connected ducts.
- C. Extra-Wide Metal-Edged Connectors: Factory fabricated with a strip of fabric 5-3/4 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized, sheet steel or 0.032-inch aluminum sheets. Select metal compatible with connected ducts.
- D. Transverse Metal-Edged Connectors: Factory fabricated with a strip of fabric 3-1/2 inches wide attached to two strips of 4-3/8-inch- wide, 0.028-inch- thick, galvanized, sheet steel or 0.032-inch aluminum sheets. Select metal compatible with connected ducts.
- E. Conventional, Indoor System Flexible Connector Fabric: Glass fabric double coated with polychloroprene.
  - 1. Minimum Weight: 26 oz./sq. yd..
  - 2. Tensile Strength: 480 lbf/inch in the warp, and 360 lbf/inch in the filling.
- F. Conventional, Outdoor System Flexible Connector Fabric: Glass fabric double coated with a synthetic-rubber, weatherproof coating resistant to the sun's ultraviolet rays and ozone environment.
  - 1. Minimum Weight: 26 oz./sq. yd..
  - 2. Tensile Strength: 530 lbf/inch in the warp, and 440 lbf/inch in the filling.

2.9 FLEXIBLE DUCTS

- A. General: Comply with UL 181, Class 1.
- B. Flexible Ducts, Uninsulated: Spiral-wound steel spring with flameproof vinyl sheathing.
- C. Flexible Ducts, Uninsulated: Corrugated aluminum.
- D. Flexible Ducts, Insulated: Factory-fabricated, insulated, round duct, with an outer jacket enclosing 1-1/2-inch- thick, glass-fiber insulation around a continuous inner liner.
  - 1. Reinforcement: Steel-wire helix encapsulated in inner liner.
  - 2. Outer Jacket: Glass-reinforced, silver Mylar with a continuous hanging tab, integral fibrous-glass tape, and nylon hanging cord.
  - 3. Outer Jacket: Polyethylene film.

4. Inner Liner: Polyethylene film.

E. Pressure Rating: 6-inch wg positive, 1/2-inch wg negative.

## 2.10 ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments, and length to suit duct insulation thickness.
- B. Splitter Damper Accessories: Zinc-plated damper blade bracket; 1/4-inch, zinc-plated operating rod; and a duct-mounted, ball-joint bracket with flat rubber gasket and square-head set screw.
- C. Flexible Duct Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action, in sizes 3 to 18 inches to suit duct size.
- D. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install duct accessories according to applicable details shown in SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for metal ducts and NAIMA's "Fibrous Glass Duct Construction Standards" for fibrous-glass ducts.
- B. Install volume dampers in lined duct; avoid damage to and erosion of duct liner.
- C. Provide test holes at fan inlet and outlet and elsewhere as indicated.
- D. Install fire and smoke dampers according to manufacturer's UL-approved written instructions.
  - 1. Install fusible links in fire dampers.
- E. Install duct access panels for access to both sides of duct coils. Install duct access panels downstream from volume dampers, fire dampers, turning vanes, and equipment.
  - 1. Install duct access panels to allow access to interior of ducts for cleaning, inspecting, adjusting, and maintaining accessories and terminal units.
  - 2. Install access panels on side of duct where adequate clearance is available.
- F. Label access doors according to Division 15 Section "Mechanical Identification."

### 3.2 ADJUSTING

- A. Adjust duct accessories for proper settings.
- B. Adjust fire and smoke dampers for proper action.
- C. Final positioning of manual-volume dampers is specified in Division 15 Section "Testing, Adjusting, and Balancing."

END OF SECTION 233300

## SECTION 233416 - POWER VENTILATORS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1.
  - 2. Centrifugal wall ventilators.
  - 3. Ceiling-mounting ventilators.
  - 4. In-line centrifugal fans.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base air ratings on 1350 ft. above sea level.
- B. Operating Limits: Classify according to AMCA 99.

#### 1.4 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
  - 1. Certified fan performance curves with system operating conditions indicated.
  - 2. Certified fan sound-power ratings.
  - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
  - 4. Material gages and finishes, including color charts.
  - 5. Dampers, including housings, linkages, and operators.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
  - 2. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.
- C. Maintenance Data: For power ventilators to include in maintenance manuals specified in Division 1.

#### 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.

- C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
- D. UL Standard: Power ventilators shall comply with UL 705.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fans as factory-assembled unit, to the extent allowable by shipping limitations, with protective crating and covering.
- B. Disassemble and reassemble units, as required for moving to final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.

#### 1.7 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."
- C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

#### 1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Belts: One set for each belt-driven unit.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1.
  - 2. Centrifugal Wall Ventilators:
    - a. Cook, Loren Company.
    - b. Greenheck Fan Corp.
    - c. JennFan; Div. of Breidert Air Products, Inc.
    - d. Penn Ventilation Companies, Inc.
  - 3. Ceiling-Mounting Ventilators:
    - a. Cook, Loren Company.
    - b. Greenheck Fan Corp.
    - c. JennFan; Div. of Breidert Air Products, Inc.
    - d. Penn Ventilation Companies, Inc.

#### 2.2

- 1.
- 2. Mounting Pedestal: Galvanized steel with removable access panel.

## 2.3 CEILING-MOUNTING VENTILATORS

- A. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.
- B. Housing: Steel, lined with acoustical insulation.
- C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.
- D. Grille: Stainless-steel, louvered grille with flange on intake and thumbscrew attachment to fan housing.
- E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.
- F. Accessories:
  - 1. Isolation: Rubber-in-shear vibration isolators.
  - 2. Manufacturer's standard roof jack or wall cap, and transition fittings.

## 2.4 WALL MOUNTED FANS

- A. Description:
- B. Housing: Fans shall be complete with wall sleeve and housing, unit shall have motorized discharge damper
- C. Wall fans shall be mounted to steel angle mounted to precast wall panel. Re: detail on plans
- D. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.
- E. Accessories:
  - 1. Companion Flanges: For inlet and outlet duct connections.
  - 2. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
  - 3. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.

## 2.5 MOTORS

- A. Refer to Division 15 Section "Motors" for general requirements for factory-installed motors.
- B. Motor Construction: NEMA MG 1, general purpose, continuous duty, Design B.
- C. Enclosure Type: Open dripproof.

## 2.6 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

- B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
- C. Install units with clearances for service and maintenance.
- D. Label units according to requirements specified in Division 15 Section "Mechanical Identification."
- E. Wall fans shall be mounted behind FEMA louver, Re: detail on plans

#### 3.2 CONNECTIONS

- A. Duct installation and connection requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 15 Section "Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment.
- D. 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.

#### 3.3 FIELD QUALITY CONTROL

- A. Equipment Startup Checks:
  - 1. Verify that shipping, blocking, and bracing are removed.
  - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
  - 3. Verify that cleaning and adjusting are complete.
  - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
  - 5. Verify lubrication for bearings and other moving parts.
  - 6. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
  - 7. Disable automatic temperature-control operators.
- B. Starting Procedures:
  - 1. Energize motor and adjust fan to indicated rpm.
  - 2. Measure and record motor voltage and amperage.
- C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.



- D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Shut unit down and reconnect automatic temperature-control operators.
- F. Refer to Division 15 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.
- G. Replace fan and motor pulleys as required to achieve design airflow.
- H. Repair or replace malfunctioning units. Retest as specified above after repairs or replacements are made.

#### 3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Lubricate bearings.

#### 3.5 CLEANING

- A. On completion of installation, internally clean fans according to manufacturer's written instructions. Remove foreign material and construction debris. Vacuum fan wheel and cabinet.
- B. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

#### 3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain power ventilators.
  - 1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
  - 2. Review data in maintenance manuals. Refer to Division 1 Section "Closeout Procedures."
  - 3. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
  - 4. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 233416

## **SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.
- B. Related Sections include the following:
  - 1. Division 23 Section "Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.
  - 2. Division 23 Section "Testing, Adjusting, and Balancing" for balancing diffusers, registers, and grilles.

#### **1.3 DEFINITIONS**

- A. Diffuser: Circular, square, or rectangular air distribution outlet, generally located in the ceiling and comprised of deflecting members discharging supply air in various directions and planes and arranged to promote mixing of primary air with secondary room air.
- B. Grille: A louvered or perforated covering for an opening in an air passage, which can be located in a sidewall, ceiling, or floor.
- C. Register: A combination grille and damper assembly over an air opening.

#### **1.4 SUBMITTALS**

- A. Product Data: For each model indicated, include the following:
  - 1. Data Sheet: For each type of air outlet and inlet, and accessory furnished; indicate construction, finish, and mounting details.
  - 2. Performance Data: Include throw and drop, static-pressure drop, and noise ratings for each type of air outlet and inlet.
  - 3. Schedule of diffusers, registers, and grilles indicating drawing designation, room location, quantity, model number, size, and accessories furnished.
  - 4. Assembly Drawing: For each type of air outlet and inlet; indicate materials and methods of assembly of components.

#### **1.5 QUALITY ASSURANCE**

- A. Product Options: Drawings and schedules indicate specific requirements of diffusers, registers, and grilles and are based on the specific requirements of the systems indicated. Other manufacturers' products with equal performance characteristics may be considered. Refer to Division 1 Section "Substitutions."
- B. NFPA Compliance: Install diffusers, registers, and grilles according to NFPA 90A, "Standard for the Installation of Air-Conditioning and Ventilating Systems."

## PART 2 - PRODUCTS

### 2.1 MANUFACTURED UNITS

- A. Diffusers, registers, and grilles are scheduled on Drawings.

### 2.2 SOURCE QUALITY CONTROL

- A. Testing: Test performance according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb, according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of the panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connection to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

### 3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

3.4 CLEANING

- A. After installation of diffusers, registers, and grilles, inspect exposed finish. Clean exposed surfaces to remove burrs, dirt, and smudges. Replace diffusers, registers, and grilles that have damaged finishes.

3.5 DIFFUSER SCHEDULE (Refer to the Drawings)

**END OF SECTION 233713**



## **SECTION 260000 - BASIC ELECTRICAL MATERIALS AND METHODS**

### **PART 1 - GENERAL**

- 1.1 Project is remodel with revised electrical. All electrical shall be reconnected to existing  
Supplying new breakers as required. New Roof TOP mech shall be reconnected to existing  
Feeders. Coordinate sizes of feeders and breakers for new equipment and replace if needed.

### **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. This Section includes the following:
1. Raceways.
  2. Building wire and connectors.
  3. Supporting devices for electrical components.
  4. Electrical identification.
  5. Electricity-metering components.
  6. Concrete equipment bases.
  7. Electrical demolition.
  8. Cutting and patching for electrical construction.
  9. Touchup painting.

### **1.4 DEFINITIONS**

- A. EMT: Electrical metallic tubing.
- B. FMC: Flexible metal conduit.
- C. IMC: Intermediate metal conduit.
- D. LFMC: Liquidtight flexible metal conduit.
- E. RNC: Rigid nonmetallic conduit.

### **1.5 SUBMITTALS**

- A. Product Data: For electricity-metering equipment.
- B. Shop Drawings: Dimensioned plans and sections or elevation layouts of electricity-metering equipment.
- C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

#### 1.6 QUALITY ASSURANCE

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

#### 1.7 COORDINATION

- A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.
  - 1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.
- B. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.
- C. Coordinate electrical service connections to components furnished by utility companies.
  - 1. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
  - 2. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.
- D. Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in Division 8 Section "Access Doors."
- E. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.
- F. Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

### PART 2 - PRODUCTS

## 2.1 RACEWAYS

- A. EMT: ANSI C80.3, zinc-coated steel, with set-screw or compression fittings.
- B. FMC: Zinc-coated steel.
- C. IMC: ANSI C80.6, zinc-coated steel, with threaded fittings.
- D. LFMC: Zinc-coated steel with sunlight-resistant and mineral-oil-resistant plastic jacket.
- E. RNC: NEMA TC 2, Schedule 40 PVC, with NEMA TC3 fittings.
- F. Raceway Fittings: Specifically designed for the raceway type with which used.

## 2.2 CONDUCTORS

- A. Conductors, No. 10 AWG and Smaller: Solid or stranded copper.
- B. Conductors, Larger Than No. 10 AWG: Stranded copper.
- C. Insulation: Thermoplastic, rated at 75 deg C minimum.
- D. Wire Connectors and Splices: Units of size, ampacity rating, material, type, and class suitable for service indicated.

## 2.3 SUPPORTING DEVICES

- A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.
- B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.
- C. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch- (14-mm-) diameter slotted holes at a maximum of 2 inches (50 mm) o.c., in webs.
- D. Slotted-Steel Channel Supports: Comply with Division 5 Section "Metal Fabrications" for slotted channel framing.
  - 1. Channel Thickness: Selected to suit structural loading.
  - 2. Fittings and Accessories: Products of the same manufacturer as channel supports.
- E. Nonmetallic Channel and Angle Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- (14-mm-) diameter holes at a maximum of 8 inches (203 mm) o.c., in at least one surface.
  - 1. Fittings and Accessories: Products of the same manufacturer as channels and angles.



- 2. Fittings and Accessory Materials: Same as channels and angles, except metal items may be stainless steel.
- F. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.
- G. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.
- H. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs have number and size of conductor gripping holes as required to suit individual risers. Body constructed of malleable-iron casting with hot-dip galvanized finish.
- I. Expansion Anchors: Carbon-steel wedge or sleeve type.
- J. Toggle Bolts: All-steel springhead type.
- K. Powder-Driven Threaded Studs: Heat-treated steel.

## 2.4 ELECTRICAL IDENTIFICATION

- A. Identification Devices: A single type of identification product for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.
- B. Raceway and Cable Labels: Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway and cable size.
  - 1. Type: Pretensioned, wraparound plastic sleeves. Flexible, preprinted, color-coded, acrylic band sized to suit the diameter of the item it identifies.
  - 2. Type: Preprinted, flexible, self-adhesive, vinyl. Legend is overlaminated with a clear, weather- and chemical-resistant coating.
  - 3. Color: Black letters on orange background.
  - 4. Legend: Indicates voltage.
- C. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape, not less than **1 inch wide by 3 mils thick (25 mm wide by 0.08 mm thick)**.
- D. Underground Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape with the following features:
  - 1. Not less than **6 inches wide by 4 mils thick (150 mm wide by 0.102 mm thick)**.
  - 2. Compounded for permanent direct-burial service.
  - 3. Embedded continuous metallic strip or core.
  - 4. Printed legend that indicates type of underground line.
- E. Tape Markers for Wire: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

- F. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.
- G. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners **1/16-inch (1.6-mm)** minimum thickness for signs up to **20 sq. in. (129 sq. cm)** and **1/8-inch (3.2-mm)** minimum thickness for larger sizes. Engraved legend in black letters on white background.
- H. Interior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Preprinted, aluminum, baked-enamel-finish signs, punched or drilled for mechanical fasteners, with colors, legend, and size appropriate to the application.
- I. Exterior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with **0.0396-inch (1-mm)**, galvanized-steel backing, with colors, legend, and size appropriate to the application. **1/4-inch (6-mm)** grommets in corners for mounting.
- J. Fasteners for Nameplates and Signs: Self-tapping, stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

## 2.5 CONCRETE BASES

- A. Concrete Forms and Reinforcement Materials: As specified in Division 3 Section "Cast-in-Place Concrete."
- B. Concrete: **3000-psi (20.7-MPa)**, 28-day compressive strength as specified in Division 3 Section "Cast-in-Place Concrete."

## 2.6 TOUCHUP PAINT

- A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.
- B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

## PART 3 - EXECUTION

### 3.1 ELECTRICAL EQUIPMENT INSTALLATION

- A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.
- B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

- C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.
- D. Right of Way: Give to raceways and piping systems installed at a required slope.

### 3.2 RACEWAY APPLICATION

- A. Use the following raceways for outdoor installations:
  - 1. Exposed: IMC.
  - 2. Concealed: IMC.
  - 3. Underground, Single Run: RNC.
  - 4. Underground, Grouped: RNC.
  - 5. Connection to Vibrating Equipment: LFMC.
  - 6. Boxes and Enclosures: NEMA 250, Type 3R or Type 4.
- B. Use the following raceways for indoor installations:
  - 1. Exposed: EMT.
  - 2. Concealed: EMT.
  - 3. Connection to Vibrating Equipment: FMC; except in wet or damp locations, use LFMC.
  - 4. Damp or Wet Locations: IMC.
  - 5. Boxes and Enclosures: NEMA 250, Type 1, unless otherwise indicated.

### 3.3 RACEWAY AND CABLE INSTALLATION

- A. Conceal raceways and cables, unless otherwise indicated, within finished walls, ceilings, and floors.
- B. Install raceways and cables at least 6 inches (150 mm) away from parallel runs of flues and hot-water pipes. Locate horizontal raceway runs above water piping.
- C. Use temporary raceway caps to prevent foreign matter from entering.
- D. Make conduit bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.
- E. Use raceway and cable fittings compatible with raceways and cables and suitable for use and location.
- F. Install raceways embedded in slabs in middle third of slab thickness where practical, and leave at least 1-inch (25-mm) concrete cover.
  - 1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
  - 2. Space raceways laterally to prevent voids in concrete.

3. Install conduit larger than **1-inch trade size (DN27)** parallel to or at right angles to main reinforcement. Where conduit is at right angles to reinforcement, place conduit close to slab support.
  4. Transition from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above floor.
  5. Make bends in exposed parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for exposed parallel raceways.
- G. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than **200-lb (90-kg)** tensile strength. Leave at least **12 inches (300 mm)** of slack at each end of the pull wire.
- H. Install telephone and signal system raceways, **2-inch trade size (DN53)** and smaller, in maximum lengths of **150 feet (45 m)** and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements, in addition to requirements above.
- I. Connect motors and equipment subject to vibration, noise transmission, or movement with a maximum of **72-inch (1830-mm)** flexible conduit. Install LFMC in wet or damp locations. Install separate ground conductor across flexible connections.
- J. Set floor boxes level and trim after installation to fit flush to finished floor surface.

### 3.4 WIRING METHODS FOR POWER, AND CONTROL CIRCUITS

- A. Feeders: **[Type THHN/THWN insulated conductors in raceway] [Metal-clad cable]**.
- B. Underground Feeders and Branch Circuits: Type THWN or single-wire, Type UF insulated conductors in raceway.
- C. Branch Circuits: Type THHN/THWN insulated conductors in raceway.
- D. Branch Circuits: Type THW or THHN/THWN insulated conductors in raceway where exposed. Metal-clad cable where concealed in ceilings and gypsum board partitions.
- E. Branch Circuits: Type THW or THHN/THWN insulated conductors in raceway where exposed. Armored or nonmetallic sheathed cable where permitted by authorities having jurisdiction and where concealed in ceilings and gypsum board partitions.
- F. Remote-Control Signaling and Power-Limited Circuits: Type THHN/THWN insulated conductors in raceway for Classes 1, 2, and 3, unless otherwise indicated.

### 3.5 WIRING INSTALLATION

- A. Install splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

- B. Install wiring at outlets with at least 12 inches (300 mm) of slack conductor at each outlet.
- C. Connect outlet and component connections to wiring systems and to ground. 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.

### 3.6 ELECTRICAL SUPPORTING DEVICE APPLICATION

- A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.
- B. Dry Locations: Steel materials.
- C. Support Clamps for PVC Raceways: Click-type clamp system.
- D. Selection of Supports: Comply with manufacturer's written instructions.
- E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb (90-kg) design load.

### 3.7 SUPPORT INSTALLATION

- A. Install support devices to securely and permanently fasten and support electrical components.
- B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.
- C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
- D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.
- E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.
- F. Install 1/4-inch- (6-mm-) diameter or larger threaded steel hanger rods, unless otherwise indicated.
- G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch (38-mm) and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.
- H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- I. Simultaneously install vertical conductor supports with conductors.

- J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches (610 mm) from the box.
- K. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.
- L. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.
- M. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:
  - 1. Wood: Fasten with wood screws or screw-type nails.
  - 2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
  - 3. New Concrete: Concrete inserts with machine screws and bolts.
  - 4. Existing Concrete: Expansion bolts.
  - 5. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
  - 6. Steel: Welded threaded studs or spring-tension clamps on steel.
    - a. Field Welding: Comply with AWS D1.1.
  - 7. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
  - 8. Light Steel: Sheet-metal screws.
  - 9. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

### 3.8 IDENTIFICATION MATERIALS AND DEVICES

- A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.
- C. Self-Adhesive Identification Products: Clean surfaces before applying.
- D. Identify raceways and cables with color banding as follows:

1. Bands: Pretensioned, snap-around, colored plastic sleeves or colored adhesive marking tape. Make each color band **2 inches (51 mm)** wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
  2. Band Locations: At changes in direction, at penetrations of walls and floors, at **50-foot (15-m)** maximum intervals in straight runs, and at **25-foot (8-m)** maximum intervals in congested areas.
- E. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.
- F. Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate **6 to 8 inches (150 to 200 mm)** below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed **16 inches (400 mm)**, overall, use a single line marker.
- G. Color-code 208/120-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:
1. Phase A: Black.
  2. Phase B: Red.
  3. Phase C: Blue.
- H. Install warning, caution, and instruction signs where required to comply with 29 CFR, Chapter XVII, Part 1910.145, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
- I. Install engraved-laminated emergency-operating signs with white letters on red background with minimum **3/8-inch- (9-mm-)** high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.
- 3.9 UTILITY COMPANY ELECTRICITY-METERING EQUIPMENT
- A. Install equipment according to utility company's written requirements. Provide grounding and empty conduits as required by utility company.
- 3.10 CONCRETE BASES
- A. Construct concrete bases of dimensions indicated, but not less than **4 inches (100 mm)** larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless

otherwise indicated. Use **3000-psi (20.7-MPa)**, 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

### 3.11 DEMOLITION

- A. Protect existing electrical equipment and installations indicated to remain. If damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.
- B. Accessible Work: Remove exposed electrical equipment and installations, indicated to be demolished, in their entirety.
- C. Abandoned Work: Cut and remove buried raceway and wiring, indicated to be abandoned in place, **2 inches (50 mm)** below the surface of adjacent construction. Cap raceways and patch surface to match existing finish.
- D. Remove demolished material from Project site.
- E. Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation.

### 3.12 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.
- B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

### 3.13 FIELD QUALITY CONTROL

- A. Inspect installed components for damage and faulty work, including the following:
  - 1. Raceways.
  - 2. Building wire and connectors.
  - 3. Supporting devices for electrical components.
  - 4. Electrical identification.
  - 5. Electricity-metering components.
  - 6. Concrete bases.
  - 7. Electrical demolition.
  - 8. Cutting and patching for electrical construction.
  - 9. Touchup painting.
- B. Test Owner's electricity-metering installation for proper operation, accuracy, and usability of output data.



1. Connect a load of known kW rating, 1.5 kW minimum, to a circuit supplied by the metered feeder.
2. Turn off circuits supplied by the metered feeder and secure them in the "off" condition.
3. Run the test load continuously for eight hours, minimum, or longer to obtain a measurable meter indication. Use a test load placement and setting that ensure continuous, safe operation.
4. Check and record meter reading at end of test period and compare with actual electricity used based on test load rating, duration of test, and sample measurements of supply voltage at the test load connection. Record test results.
5. Repair or replace malfunctioning metering equipment or correct test setup; then retest. Repeat for each meter in installation until proper operation of entire system is verified.

#### 3.14 REFINISHING AND TOUCHUP PAINTING

- A. Refinish and touch up paint. Paint materials and application requirements are specified in Division 9 Section "Painting."
  1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.
  2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
  3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

#### 3.15 CLEANING AND PROTECTION

- A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
- B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION 260000

## **SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL**

### **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:

Reconnection of existing electrical to new Rooftop equip

1. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Grout.
5. Common electrical installation requirements.

#### **1.3 DEFINITIONS**

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

#### **1.4 SUBMITTALS**

- A. Product Data: For sleeve seals.

#### **1.5 COORDINATION**

- A. Coordinate arrangement, mounting, and support of electrical equipment:
  1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
  2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
  3. To allow right of way for piping and conduit installed at required slope.
  4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

## PART 2 - PRODUCTS

### 2.1 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel.
  - 1. Minimum Metal Thickness:
    - a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches, thickness shall be 0.052 inch.
    - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

### 2.2 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.
  - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
  - 3. Pressure Plates: Carbon steel. Include two for each sealing element.

4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.3 GROUT

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

## PART 3 - EXECUTION

### 3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

### 3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.

- F. Extend sleeves installed in floors 2 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
  - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

### 3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### 3.4 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 260500

## **SECTION 260518 - ELECTRICAL POWER CONDUCTORS AND CABLES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Any new electrical added to the existing system shall conform to this spec
- B. This Section includes the following:
  - 1. Building wires and cables rated 600 V and less.
  - 2. Connectors, splices, and terminations rated 600 V and less.
  - 3. Sleeves and sleeve seals for cables.

#### **1.3 DEFINITIONS**

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

#### **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. Comply with NFPA 70.

#### **1.5 COORDINATION**

- A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

## PART 2 - PRODUCTS

### 2.1 CONDUCTORS AND CABLES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Alcan Products Corporation; Alcan Cable Division.
  - 2. American Insulated Wire Corp.; a Leviton Company.
  - 3. General Cable Corporation.
  - 4. Senator Wire & Cable Company.
  - 5. Southwire Company.
- B. Aluminum and Copper Conductors: Comply with NEMA WC 70.
- C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.
- D. Multi-conductor Cable: Comply with NEMA WC 70 for Type MC metal-clad cable with ground wire.

### 2.2 CONNECTORS AND SPLICES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. AFC Cable Systems, Inc.
  - 2. Hubbell Power Systems, Inc.
  - 3. O-Z/Gedney; EGS Electrical Group LLC.
  - 4. 3M; Electrical Products Division.
  - 5. Tyco Electronics Corp.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

### 2.3 SLEEVES FOR CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.138-inch thickness as indicated and of length to suit application.
- C. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

## 2.4 SLEEVE SEALS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Advance Products & Systems, Inc.
  - 2. Calpico, Inc.
  - 3. Metraflex Co.
  - 4. Pipeline Seal and Insulator, Inc.
- B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
  - 1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
  - 2. Pressure Plates: Carbon steel. Include two for each sealing element.
  - 3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## PART 3 - EXECUTION

### 3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper for feeders smaller than No. 3 AWG; copper or aluminum for feeders No. 3 AWG and larger. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

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

- A. Service Entrance: Type THHN-THWN, single conductors in raceway.
- B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway, Metal-clad cable, Type MC.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- E. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway, Metal-clad cable, Type MC.



- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway, Metal-clad cable, Type MC.
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- H. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- I. Class 2 Control Circuits: Type THHN-THWN, in raceway.

### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."
- F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

### 3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A 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 un-spliced conductors.
  - 1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

### 3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Rectangular Sleeve Minimum Metal Thickness:
  - 1. For sleeve rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
  - 2. For sleeve rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both wall surfaces.
- G. Extend sleeves installed in floors 2 inches above finished floor level.
- H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and cable unless sleeve seal is to be installed.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 07 Section "Joint Sealants."
- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to Division 07 Section "Penetration Firestopping."
- L. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.
- M. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- N. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between cable and sleeve for installing mechanical sleeve seals.

### 3.6 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground exterior-wall penetrations.

- B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### 3.7 FIRESTOPPING

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

END OF SECTION 260518

## **SECTION 260519 - ELECTRICAL POWER CONDUCTORS AND CABLES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Building wires and cables rated 600 V and less.
  - 2. Connectors, splices, and terminations rated 600 V and less.
  - 3. Sleeves and sleeve seals for cables.

#### **1.3 DEFINITIONS**

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

#### **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. Comply with NFPA 70.

#### **1.5 COORDINATION**

- A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

### **PART 2 - PRODUCTS**

#### **2.1 CONDUCTORS AND CABLES**

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

1. Alcan Products Corporation; Alcan Cable Division.
2. American Insulated Wire Corp.; a Leviton Company.
3. General Cable Corporation.
4. Senator Wire & Cable Company.
5. Southwire Company.

- B. Aluminum and Copper Conductors: Comply with NEMA WC 70.
- C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.
- D. Multi-conductor Cable: Comply with NEMA WC 70 for Type MC metal-clad cable with ground wire.

## 2.2 CONNECTORS AND SPLICES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. AFC Cable Systems, Inc.
  2. Hubbell Power Systems, Inc.
  3. O-Z/Gedney; EGS Electrical Group LLC.
  4. 3M; Electrical Products Division.
  5. Tyco Electronics Corp.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

## 2.3 SLEEVES FOR CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.138-inch thickness as indicated and of length to suit application.
- C. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

## 2.4 SLEEVE SEALS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Advance Products & Systems, Inc.
  2. Calpico, Inc.
  3. Metraflex Co.
  4. Pipeline Seal and Insulator, Inc.

- B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
  - 1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
  - 2. Pressure Plates: Carbon steel. Include two for each sealing element.
  - 3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

### PART 3 - EXECUTION

#### 3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper for feeders smaller than No. 3 AWG; copper or aluminum for feeders No. 3 AWG and larger. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

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

- A. Service Entrance: Type THHN-THWN, single conductors in raceway.
- B. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway, Metal-clad cable, Type MC.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- E. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway, Metal-clad cable, Type MC.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway, Metal-clad cable, Type MC.
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- H. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- I. Class 2 Control Circuits: Type THHN-THWN, in raceway.

### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."
- F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

### 3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A 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 un-spliced conductors.
  - 1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

### 3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Section "Penetration Firestopping."
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Rectangular Sleeve Minimum Metal Thickness:
  - 1. For sleeve rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
  - 2. For sleeve rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.

- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both wall surfaces.
- G. Extend sleeves installed in floors 2 inches above finished floor level.
- H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and cable unless sleeve seal is to be installed.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 07 Section "Joint Sealants."
- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to Division 07 Section "Penetration Firestopping."
- L. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.
- M. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- N. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between cable and sleeve for installing mechanical sleeve seals.

### 3.6 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground exterior-wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### 3.7 FIRESTOPPING

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

**END OF SECTION 260519**



## **SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

### **PART 1 - GENERAL**

- 1.1 All grounding required for new work shall conform to this spec
- 1.2 RELATED DOCUMENTS
  - A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- 1.3 SUMMARY
  - A. This Section includes methods and materials for grounding systems and equipment.
- 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. Comply with UL 467 for grounding and bonding materials and equipment.

### **PART 2 - PRODUCTS**

- 2.1 CONDUCTORS
  - A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
  - B. Bare Copper Conductors:
    - 1. Solid Conductors: ASTM B 3.
    - 2. Stranded Conductors: ASTM B 8.
    - 3. Tinned Conductors: ASTM B 33.
    - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
    - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
    - 6. Bonding Jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
    - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

## 2.2 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
  - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

## PART 3 - EXECUTION

### 3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.
- B. Grounding Bus: Install in communication systems equipment rooms, and elsewhere as indicated.
  - 1. Install bus on insulated spacers 1-inch, minimum, from wall 6-inches above finished floor, unless otherwise indicated.
- C. Conductor Terminations and Connections:
  - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  - 2. Connections to Structural Steel: Welded connectors.

### 3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
  - 1. Feeders and branch circuits.
  - 2. Lighting circuits.
  - 3. Receptacle circuits.
  - 4. Single-phase motor and appliance branch circuits.
  - 5. Three-phase motor and appliance branch circuits.
  - 6. Flexible raceway runs.
  - 7. Armored and metal-clad cable runs.

- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. Water Heater, Heat-Tracing, and Anti-frost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- E. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
  - 1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
  - 2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

### 3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.
  - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
  - 3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
- D. Grounding and Bonding for Piping:
  - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is

- installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
- 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
- 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
- F. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet of electrically conductive coated steel reinforcing bar, or bare copper conductor not smaller than No. 4 AWG.

### 3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
  - 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
  - 2. Test completed grounding system at service disconnect enclosure grounding terminal(s).
- B. Report measured ground resistances that exceed the following values:
  - 1. Power and Lighting Equipment or System with capacity 500 kVA and less: 10 ohms.
  - 2. Power and Lighting Equipment or System with capacity 500 to 1000 kVA: 5 ohms.
  - 3. Power and Lighting Equipment or System with capacity more Than 1000 kVA: 3 ohms.
  - 4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohms.
  - 5. Pad-Mounted Equipment: 5 ohms.
- C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

## SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Hangers and supports for electrical equipment and systems.
  - 2. Construction requirements for concrete bases.

#### 1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of [five] <Insert number> times the applied force.

#### 1.5 SUBMITTALS

- A. Product Data: For the following:
  - 1. Steel slotted support systems.
  - 2. Nonmetallic slotted support systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.
2. Steel slotted channel systems. Include Product Data for components.
3. Nonmetallic slotted channel systems. Include Product Data for components.
4. Equipment supports.

#### 1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

#### 1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

### PART 2 - PRODUCTS

#### 2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
  1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Allied Tube & Conduit.
    - b. Cooper B-Line, Inc.; a division of Cooper Industries.
    - c. ERICO International Corporation.
    - d. GS Metals Corp.
    - e. Thomas & Betts Corporation.
    - f. Unistrut; Tyco International, Ltd.
  3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
  5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
  6. Channel Dimensions: Selected for applicable load criteria.
- B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- (14-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c., in at least 1 surface.
  1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Allied Tube & Conduit.

- b. Cooper B-Line, Inc.; a division of Cooper Industries.
  - c. Fabco Plastics Wholesale Limited.
- 3. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
- 4. Fitting and Accessory Materials: Same as channels and angles[, **except metal items may be stainless steel**].
- 5. Rated Strength: Selected to suit applicable load criteria.
- C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- G. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
  - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
    - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Hilti Inc.
      - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      - 3) MKT Fastening, LLC.
      - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
  - 2. Mechanical-Expansion Anchors: Insert-wedge-type, **zinc-coated** steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
    - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
      - 2) Empire Tool and Manufacturing Co., Inc.
      - 3) Hilti Inc.
      - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
  - 3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
  - 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.

5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

## 2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as **required by** NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

### 3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  1. To Wood: Fasten with lag screws or through bolts.
  2. To New Concrete: Bolt to concrete inserts.
  3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  4. To Existing Concrete: Expansion anchor fasteners. Verify anchor fasteners chosen are approved by precast manufacturer.



5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
  6. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

### 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

### 3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi (20.7-MPa, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03. Anchor equipment to concrete base.
  1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  2. Install anchor bolts to elevations required for proper attachment to supported equipment.
  3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

### 3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  1. Apply paint with a brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touchup: Comply with requirements in Division 09 Painting for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

**END OF SECTION 260529**

## **SECTION 260533 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS**

### **PART 1 - GENERAL**

- 1.1 Any raceway or boxes for new work or connection to the existing system shall conform to this spec
- 1.2 RELATED DOCUMENTS
  - A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- 1.3 SUMMARY
  - A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- 1.4 DEFINITIONS
  - A. EMT: Electrical metallic tubing.
  - B. ENT: Electrical nonmetallic tubing.
  - C. EPDM: Ethylene-propylene-diene terpolymer rubber.
  - D. FMC: Flexible metal conduit.
  - E. IMC: Intermediate metal conduit.
  - F. LFMC: Liquid-tight flexible metal conduit.
  - G. LFNC: Liquid-tight flexible nonmetallic conduit.
  - H. NBR: Acrylonitrile-butadiene rubber.
  - I. RNC: Rigid nonmetallic conduit.
- 1.5 QUALITY ASSURANCE
  - A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
  - B. Comply with NFPA 70.

## PART 2 - PRODUCTS

### 2.1 METAL CONDUIT AND TUBING

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. AFC Cable Systems, Inc.
  - 2. Alflex Inc.
  - 3. Allied Tube & Conduit; a Tyco International Ltd. Co.
  - 4. Anamet Electrical, Inc.; Anaconda Metal Hose.
  - 5. Electri-Flex Co.
  - 6. O-Z Gedney; a unit of General Signal.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. EMT: ANSI C80.3.
- D. FMC: Zinc-coated steel.
- E. LFMC: Flexible steel conduit with PVC jacket.
- F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
  - 1. Fittings for EMT: Steel, set-screw or compression type.
  - 2. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.
- G. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

### 2.2 NONMETALLIC CONDUIT AND TUBING

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. AFC Cable Systems, Inc.
  - 2. Anamet Electrical, Inc.; Anaconda Metal Hose.
  - 3. Arnco Corporation.
  - 4. CANTEX Inc.
  - 5. CertainTeed Corp.; Pipe & Plastics Group.
  - 6. Lamson & Sessions; Carlon Electrical Products.
  - 7. Manhattan/CDT/Cole-Flex.
  - 8. RACO; a Hubbell Company.

- 9. Thomas & Betts Corporation.
- B. RNC: NEMA TC 2, Type EPC-40-PVC unless otherwise indicated.
- C. LFNC: UL 1660.
- D. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.
- E. Fittings for LFNC: UL 514B.

## 2.3 METAL WIREWAYS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Cooper B-Line, Inc.
  - 2. Hoffman.
  - 3. Square D; Schneider Electric.
- B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.
- C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Screw-cover type for Type 1, Flanged-and-gasketed type for Type 3R.
- E. Finish: Manufacturer's standard enamel finish.

## 2.4 BOXES, ENCLOSURES, AND CABINETS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
  - 2. EGS/Appleton Electric.
  - 3. Erickson Electrical Equipment Company.
  - 4. Hoffman.
  - 5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
  - 6. O-Z/Gedney; a unit of General Signal.
  - 7. RACO; a Hubbell Company.
  - 8. Scott Fetzer Co.; Adalet Division.
  - 9. Spring City Electrical Manufacturing Company.
  - 10. Thomas & Betts Corporation.
  - 11. Walker Systems, Inc.; Wiremold Company (The).

- B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- D. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
- E. Metal Floor Boxes: Cast or sheet metal, fully adjustable, rectangular.
- F. Nonmetallic Floor Boxes: Nonadjustable, round.
- G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- H. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.
- I. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
  - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
  - 2. Nonmetallic Enclosures: Plastic
- J. Cabinets:
  - 1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
  - 2. Hinged door in front cover with flush latch and concealed hinge.
  - 3. Key latch to match panelboards.
  - 4. Metal barriers to separate wiring of different systems and voltage.
  - 5. Accessory feet where required for freestanding equipment.

## 2.5 SLEEVES FOR RACEWAYS

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.138-inch thickness as indicated and of length to suit application.
- C. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

## 2.6 SLEEVE SEALS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Advance Products & Systems, Inc.

2. Calpico, Inc.
  3. Metraflex Co.
  4. Pipeline Seal and Insulator, Inc.
- B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
  2. Pressure Plates: Carbon steel. Include two for each sealing element.
  3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

### PART 3 - EXECUTION

#### 3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
1. Exposed Conduit: Rigid steel conduit.
  2. Concealed Conduit, Aboveground: EMT.
  3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
  4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Comply with the following indoor applications, unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
  2. Exposed and Subject to Physical Damage: Rigid steel conduit.
  3. Concealed in Ceilings and Interior Walls and Partitions: EMT.
  4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
  5. Damp or Wet Locations: Rigid steel conduit.
  6. Raceways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air: EMT.
  7. Raceways for Optical Fiber or Communications Cable Risers in Vertical Shafts: EMT.
  8. Raceways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: EMT.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
  2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. Do not install aluminum conduits in contact with concrete.

### 3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Keep raceways at least 6 inches away from parallel runs of flues or hot-water pipes. Install horizontal raceway runs above water piping.
- C. Complete raceway installation before starting conductor installation.
- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- H. Raceways Embedded in Slabs:
1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
  2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
  3. Change to metallic conduit from Type EPC-40-PVC before rising above the floor.
- I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

- K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- L. Raceways for Optical Fiber and Communications Cable: Install raceways, metallic and nonmetallic, rigid and flexible, as follows:
  - 1. 3/4-Inch Trade Size and Smaller: Install raceways in maximum lengths of 50 feet.
  - 2. 1-Inch Trade Size and Larger: Install raceways in maximum lengths of 75 feet.
  - 3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- M. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
  - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  - 2. Where otherwise required by NFPA 70.
- N. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet.
  - 1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
    - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    - c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F temperature change.
  - 2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change.
  - 3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.
- O. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semi-recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
  - 1. Use LFMC in damp or wet locations subject to severe physical damage.
  - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.



- P. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
- Q. Set metal floor boxes level and flush with finished floor surface.
- R. Set non-metallic floor boxes level. Trim after installation to fit flush with finished floor surface.

### 3.3 INSTALLATION OF UNDERGROUND CONDUIT

#### A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than **6 inches** in nominal diameter.
2. Install backfill as specified in Division 31 Section "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand-tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within **12 inches** of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
  - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with **3 inches** of concrete.
  - b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of **60 inches** from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

### 3.4 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Rectangular Sleeve Minimum Metal Thickness:

1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches , thickness shall be 0.052 inch.
  2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches , thickness shall be 0.138 inch.
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both surfaces of walls.
- G. Extend sleeves installed in floors 2 inches above finished floor level.
- H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."
- L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.
- M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway and sleeve for installing mechanical sleeve seals.

### 3.5 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground, exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.6 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.7 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

## **SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Identification for raceway and metal-clad cable.
  - 2. Identification for conductors and communication and control cable.
  - 3. Underground-line warning tape.
  - 4. Warning labels and signs.
  - 5. Instruction signs.
  - 6. Equipment identification labels.
  - 7. Miscellaneous identification products.

#### **1.3 SUBMITTALS**

- A. Product Data: For each electrical identification product indicated.
- B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.
- C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

#### **1.4 QUALITY ASSURANCE**

- A. Comply with ANSI A13.1 and ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.145.

#### **1.5 COORDINATION**

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the

Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

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

## PART 2 - PRODUCTS

### 2.1 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Color for Printed Legend:
  - 1. Power Circuits: Black letters on an orange field.
  - 2. Legend: Indicate system or service and voltage, if applicable.
- C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- F. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.

### 2.2 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
- B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

- C. Aluminum Wraparound Marker Labels: Cut from 0.014-inch- (0.35-mm-) thick aluminum sheet, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.
- D. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch (50 by 50 by 1.3 mm), with stamped legend, punched for use with self-locking nylon tie fastener.
- E. Write-On Tags: Polyester tag, [0.010 inch (0.25 mm)] *thickness*> thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.
  - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

## 2.3 UNDERGROUND-LINE WARNING TAPE

- A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.
  - 1. Not less than 6 inches (150 mm) wide by 4 mils (0.102 mm) thick.
  - 2. Compounded for permanent direct-burial service.
  - 3. Embedded continuous metallic strip or core.
  - 4. Printed legend shall indicate type of underground line.

## 2.4 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
- C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch (6.4-mm) grommets in corners for mounting. Nominal size, 7 by 10 inches (180 by 250 mm).
- D. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch (6.4-mm) grommets in corners for mounting. Nominal size, 10 by 14 inches (250 by 360 mm).
- E. Warning label and sign shall include, but are not limited to, the following legends:
  - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
  - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

## 2.5 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. in. (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.
  - 1. Engraved legend with **black letters on white face**
  - 2. Punched or drilled for mechanical fasteners.
  - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

## 2.6 EQUIPMENT IDENTIFICATION LABELS

- A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm).
- B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch (10 mm). Overlay shall provide a weatherproof and ultraviolet-resistant seal for label.
- C. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).
- D. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).
- E. Stenciled Legend: In nonfading, waterproof, **black** ink or paint. Minimum letter height shall be **[1 inch (25 mm)]**.

## 2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
  - 1. Minimum Width: 3/16 inch (5 mm).
  - 2. Tensile Strength: 50 lb (22.6 kg), minimum.
  - 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
  - 4. Color: Black, except where used for color-coding.
    - 1) Primer: Interior ferrous-metal primer.
    - 2) Finish Coats: Interior semigloss acrylic enamel.
- 5. Interior Zinc-Coated Metal (except Raceways):
  - a. Semigloss Acrylic-Enamel Finish: **[One]** > finish coat(s) over a primer.
    - 1) Primer: Interior zinc-coated metal primer.
    - 2) Finish Coats: Interior semigloss acrylic enamel.

- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Raceways and Duct Banks More Than 600 V Concealed within Buildings: 4-inch- (100-mm-) wide black stripes on 10-inch (250-mm) centers over orange background that extends full length of raceway or duct and is 12 inches (300 mm) wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch- (75-mm-) high black letters on 20-inch (500-mm) centers. Stop stripes at legends. Apply to the following finished surfaces:
  - 1. Floor surface directly above conduits running beneath and within 12 inches (300 mm) of a floor that is in contact with earth or is framed above unexcavated space.
  - 2. Wall surfaces directly external to raceways concealed within wall.
  - 3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.
- B. Accessible Raceways and Metal-Clad Cables More Than 600 V: Identify with "DANGER-HIGH VOLTAGE" in black letters at least 2 inches (50 mm) high, with [**self-adhesive vinyl labels**] [**snap-around labels**]. Repeat legend at 10-foot (3-m) maximum intervals.
- C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than [**30 A**] <Insert Current>: Identify with orange [**self-adhesive vinyl label**] [**snap-around label**] [**self-adhesive vinyl tape applied in bands**].
- D. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, **self-adhesive vinyl tape applied in bands**:
  - 1. Fire Alarm System: Red.
  - 2. Fire-Suppression Supervisory and Control System: Red and yellow.
  - 3. Combined Fire Alarm and Security System: Red and blue.
  - 4. Security System: Blue and yellow.
  - 5. Mechanical and Electrical Supervisory System: Green and blue.
  - 6. Telecommunication System: Green and yellow.
  - 7. Control Wiring: Green and red.
- E. Power-Circuit Conductor Identification: For [**primary**] [**and**] [**secondary**] conductors No. [**1/0**] AWG and larger in vaults, pull and junction boxes, manholes, and handholes use **color-coding conductor tape**. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.
- F. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use **color-coding conductor labels**. Identify each ungrounded conductor according to source and circuit number.



- G. Conductors to Be Extended in the Future: Attach **write-on tags** to conductors and list source and circuit number.
- H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.
  - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
  - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
  - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.
- I. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable **Install underground-line warning tape for both direct-buried cables and cables in raceway.**
- J. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply **self-adhesive warning labels**. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
  - 1. Equipment with Multiple Power or Control Sources: Apply to door or cover of equipment including, but not limited to, the following:
    - a. Power transfer switches.
    - b. Controls with external control power connections.
  - 2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
- K. Instruction Signs:
  - 1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- L. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
  - 1. Labeling Instructions:

- a. Indoor Equipment: **Adhesive film label] label** Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where 2 lines of text are required, use labels 2 inches (50 mm) high.
  - b. Outdoor Equipment: **Engraved, laminated acrylic or melamine label.** Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
2. Equipment to Be Labeled:
- a. Panelboards, electrical cabinets, and enclosures.
  - b. Access doors and panels for concealed electrical items.
  - c. Electrical switchgear and switchboards.
  - d. Transformers.
  - e. Emergency system boxes and enclosures.
  - f. Disconnect switches.
  - g. Enclosed circuit breakers.
  - h. Motor starters.
  - i. Push-button stations.
  - j. Contactors.
  - k. Remote-controlled switches, dimmer modules, and control devices.
  - l. Voice and data cable terminal equipment.
  - m. Master clock and program equipment.
  - n. Intercommunication and call system master and staff stations.
  - o. Television/audio components, racks, and controls.
  - p. Fire-alarm control panel and annunciators.
  - q. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
  - r. Monitoring and control equipment.
  - s. Uninterruptible power supply equipment.
  - t. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.

### 3.2 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

- F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- G. Color-Coding for Phase[ **and Voltage Level**] Identification, 600 V and Less: Use the colors listed below for ungrounded **service, feeder, and branch-circuit** conductors.
  - 1. Color shall be **factory applied**
  - 2. Colors for 208/120-V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.
    - c. Phase C: Blue.
  - 3. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench [**or concrete envelope**] exceeds 16 inches (400 mm) overall.
- J. Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.

END OF SECTION 260553

## **SECTION 262726 - WIRING DEVICES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. All devices and plates shall be replaced with color selected by interior designer
- B. This Section includes the following:
  - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
  - 2. Twist-locking receptacles.
  - 3. Receptacles with integral surge suppression units.
  - 4. Wall-box motion sensors.
  - 5. Isolated-ground receptacles.
  - 6. Snap switches and wall-box dimmers.
  - 7. Solid-state fan speed controls.
  - 8. Wall-switch and exterior occupancy sensors.
  - 9. Communications outlets.
  - 10. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.
- C. Related Sections include the following:
  - 1. Division 27 Section "Communications Horizontal Cabling" for workstation outlets.

#### **1.3 DEFINITIONS**

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.
- F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations. (Kitchen)

1.7 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
  - 1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
  - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
  - 3. Leviton Mfg. Company Inc. (Leviton).
  - 4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

1.8 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; 5351 (single), 5352 (duplex).
    - b. Hubbell; HBL5351 (single), CR5352 (duplex).
    - c. Leviton; 5891 (single), 5352 (duplex).
    - d. Pass & Seymour; 5381 (single), 5352 (duplex).
- B. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Hubbell; CR 5253IG.
    - b. Leviton; 5362-IG.
    - c. Pass & Seymour; IG6300.
  3. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.
- C. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; TR8300.
    - b. Hubbell; HBL8300SG.
    - c. Leviton; 8300-SGG.
    - d. Pass & Seymour; 63H.
  3. Description: Labeled to comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.
- 1.9 GFCI RECEPTACLES
- A. General Description: Straight blade, **feed**-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
  - a. Cooper; GF20.
  - b. Pass & Seymour; 2084.

1.10 TVSS RECEPTACLES

- A. General Description: Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 1449, with integral TVSS in line to ground, line to neutral, and neutral to ground.
  1. TVSS Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 volts and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
  2. Active TVSS Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."
- B. Duplex TVSS Convenience Receptacles:
  1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; 5362BLS.
    - b. Hubbell; HBL5362SA.
    - c. Leviton; 5380.
  3. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R.
- C. Isolated-Ground, Duplex Convenience Receptacles:
  1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; IG5362BLS.
    - b. Hubbell; IG5362SA.
    - c. Leviton; 5380-IG.
  3. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.
  4. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R.

5. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
6. Products: Subject to compliance with requirements, provide one of the following:
  - a. Cooper; IG8300HGBLS.
  - b. Hubbell; IG8362SA.
  - c. Leviton; 8380-IG.
7. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R. Comply with UL 498 Supplement SD. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

#### 1.11 TWIST-LOCKING RECEPTACLES

- A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.
  1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; L520R.
    - b. Hubbell; HBL2310.
    - c. Leviton; 2310.
    - d. Pass & Seymour; L520-R.
- B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:
  1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Hubbell; IG2310.
    - b. Leviton; 2310-IG.
  3. Description: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.



1.12

1.13 CORD AND PLUG SETS

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
  - 1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
  - 2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

1.14 SNAP SWITCHES

- A. Comply with NEMA WD 1 and UL 20.
- B. Switches, 120/277 V, 20 A:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
    - b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
    - c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
    - d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).
- C. Pilot Light Switches, 20 A:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; 2221PL for 120 V and 277 V.
    - b. Hubbell; HPL1221PL for 120 V and 277 V.
    - c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
    - d. Pass & Seymour; PS20AC1-PLR for 120 V.
  - 3. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."
- D. Key-Operated Switches, 120/277 V, 20 A:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; 2221L.
    - b. Hubbell; HBL1221L.
    - c. Leviton; 1221-2L.
    - d. Pass & Seymour; PS20AC1-L.
  3. Description: Single pole, with factory-supplied key in lieu of switch handle.
- E. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; 1995.
    - b. Hubbell; HBL1557.
    - c. Leviton; 1257.
    - d. Pass & Seymour; 1251.
- F. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; 1995L.
    - b. Hubbell; HBL1557L.
    - c. Leviton; 1257L.
    - d. Pass & Seymour; 1251L.

#### 1.15 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable [slider; with single-pole or three-way switching. Comply with UL 1472.
- C. LED Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module. Compatible with LED driver

1. 600 W; dimmers shall require no derating when ganged with other devices. Retain subparagraph above or below. If retaining below, insert other dimmers with their characteristics. UL 1472 covers ratings from 300 W to 2000 W in increments of 50 W.
- D. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

#### 1.16 OCCUPANCY SENSORS

##### A. Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
  - a. Cooper; 6111 for 120 V, 6117 for 277 V.
  - b. Hubbell; WS1277.
  - c. Leviton; ODS 10-ID.
  - d. Pass & Seymour; WS3000.
  - e. Watt Stopper (The); WS-200.
3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).

##### B. Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
  - a. Hubbell; AT120 for 120 V, AT277 for 277 V.
  - b. Leviton; ODS 15-ID.
3. Description: Adaptive-technology type, 120/277 V, adjustable time delay up to 20 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m).

##### C. Long-Range Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
  - a. Hubbell; ATP1600WRP.
  - b. Leviton; ODWWV-IRW.
  - c. Pass & Seymour; WA1001.
  - d. Watt Stopper (The); CX-100.

3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, with a minimum coverage area of 1200 sq. ft. (111 sq. m).

D. Long-Range Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
  - a. Hubbell; ATD1600WRP.
  - b. Leviton; ODW12-MRW.
  - c. Watt Stopper (The); DT-200.
3. Description: Dual technology, with both passive-infrared- and ultrasonic-type sensing, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, and a minimum coverage area of 1200 sq. ft. (111 sq. m).

E. Wide-Range Wall-Switch Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
  - a. Hubbell; ATP120HBRP.
  - b. Leviton; ODWHB-IRW.
  - c. Pass & Seymour; HS1001.
  - d. Watt Stopper (The); CX-100-3.
3. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 150-degree field of view, with a minimum coverage area of 1200 sq. ft. (111 sq. m).

F. Exterior Occupancy Sensors:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
  - a. Leviton; PS200-10.
  - b. Watt Stopper (The); EW-100-120.
3. Description: Passive-infrared type, 120/277 V, weatherproof, adjustable time delay up to 15 minutes, 180-degree field of view, and 110-foot (34-m) detection range. Minimum switch rating: 1000-W incandescent, 500-VA fluorescent.

## 1.17 COMMUNICATIONS OUTLETS

A. Telephone Outlet:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
  - a. Cooper; 3560-6.
  - b. Leviton; 40649.
  - c. <Insert manufacturer's name; catalog number.>
3. Description: Single RJ-45 jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e. Comply with UL 1863.

B. Combination TV and Telephone Outlet:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
2. Products: Subject to compliance with requirements, provide one of the following:
  - a. Cooper; 3562.
  - b. Leviton; 40595.
3. Description: Single RJ-45 jack for 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e; and one Type F coaxial cable connector.

1.18 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: **Smooth, high-impact thermoplastic** [0.035- thick, Material for Unfinished Spaces: **high-impact thermoplastic**].
3. Material for Damp Locations: **Thermoplastic** with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, **die-cast aluminum** with lockable cover.

1.19 FLOOR SERVICE FITTINGS

- A. Type: Modular **flush-type** dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: **Rectangular, die-cast aluminum** with satin finish.
- D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.
- E. Voice and Data Communication Outlet: **[Blank cover with bushed cable opening**

1.20 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
  - 1. Wiring Devices and Plates Connected to Normal Power System - White

PART 2 - EXECUTION

2.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
  - 1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
  - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
  - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
  - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
  - 1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
  - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
  - 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
  - 4. Existing Conductors:
    - a. Cut back and pigtail, or replace all damaged conductors.
    - b. Straighten conductors that remain and remove corrosion and foreign matter.
    - c. Pigtailling existing conductors is permitted provided the outlet box is large enough.
- D. Device Installation:
  - 1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
  - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.

3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15-A or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles [**down**], and on horizontally mounted receptacles to the **left**. Recommendation in subparagraph below is made in IEEE 602.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

## 2.2 IDENTIFICATION

- A. Comply with Division 26 Section "Identification for Electrical Systems."

## 2.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
1. Test Instruments: Use instruments that comply with UL 1436.
  2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 262726



## **SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS**

### **PART 1 - GENERAL**

1.1 All enclosed switches or circuit brkrs required for this addition shall conform to this Spec

- A. All new roof-top equip shall have new 3R disconnects

1.2 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.

1.3 SUMMARY

- A. Section Includes:
  - 1. Fusible switches.
  - 2. Nonfusible switches.
  - 3. Receptacle switches.
  - 4. Shunt trip switches.
  - 5. Molded-case circuit breakers (MCCBs).
  - 6. Molded-case switches.
  - 7. Enclosures.
  - 8. Disconnects

1.4 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.5 SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
  - 1. Enclosure types and details for types other than NEMA 250, Type 1.
  - 2. Current and voltage ratings.
  - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).

4. Include evidence of NRTL listing for series rating of installed devices.
  5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
  6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device
- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
1. Wiring Diagrams: For power, signal, and control wiring.
- C. Qualification Data: For qualified testing agency.
- D. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- E. Field quality-control reports.
1. Test procedures used.
  2. Test results that comply with requirements.
  3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- F. Manufacturer's field service report.
- G. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
  2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device

#### 1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Comply with NFPA 70.

#### 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
  1. Ambient Temperature: Not less than **minus 22 deg F (minus 30 deg C)** and not exceeding **104 deg F (40 deg C)**.
  2. Altitude: Not exceeding **6600 feet (2010 m)**.
- B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
  1. Notify **Owner** no fewer than **sevendays** in advance of proposed interruption of electric service.
  2. Indicate method of providing temporary electric service.
  3. Do not proceed with interruption of electric service without **Owner's** written permission.
  4. Comply with NFPA 70E.

#### 1.8 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

#### 1.9 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to **[10]** percent of quantity installed for each size and type, but no fewer than **three** of each size and type.
2. Fuse Pullers: **Two** for each size and type.

## PART 2 - PRODUCTS

### 2.1 FUSIBLE SWITCHES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide **product indicated on Drawings** or comparable product by one of the following:
  1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  3. Siemens Energy & Automation, Inc.
  4. Square D; a brand of Schneider Electric.
- B. Type GD, General Duty, Single Throw, 240-V ac, 800 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with **[cartridge]** fuse interiors to accommodate **[specified]** fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Type HD, Heavy Duty, Single Throw, **600**-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate **specified** fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- D. Type HD, Heavy Duty, Six Pole, Single Throw, **600**-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate
- E. Type HD, Heavy Duty, Double Throw, **600**-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate **specified** fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- F. Accessories:
  1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
  3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
  4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
  5. Auxiliary Contact Kit: **[One]** **[Two]** NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
  6. Hookstick Handle: Allows use of a hookstick to operate the handle.
  7. Lugs: **Mechanical** type, suitable for number, size, and conductor material.
  8. Service-Rated Switches: Labeled for use as service equipment.

## 2.2 NONFUSIBLE SWITCHES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide **product indicated on Drawings** or comparable product by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  3. Siemens Energy & Automation, Inc.
  4. Square D; a brand of Schneider Electric.
- B. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Type HD, Heavy Duty, Single Throw, **600**-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- D. Type HD, Heavy Duty, Six Pole, Single Throw, **600**-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- E. Type HD, Heavy Duty, Double Throw, **600**-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- F. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
  3. Isolated Ground Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
  4. Auxiliary Contact Kit: **Two** NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
  5. Hookstick Handle: Allows use of a hookstick to operate the handle.
  6. Lugs: **Mechanical** type, suitable for number, size, and conductor material.
  7. All exterior mounted gear shall be 3R rated

## 2.3 RECEPTACLE SWITCHES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide **product indicated on Drawings** or comparable product by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.

3. Siemens Energy & Automation, Inc.
  4. Square D; a brand of Schneider Electric.
- B. Type HD, Heavy-Duty, Single-Throw Fusible Switch: **600-V ac**; UL 98 and NEMA KS 1; horsepower rated, with clips or bolt pads to accommodate **specified** fuses; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- C. Type HD, Heavy-Duty, Single-Throw Nonfusible Switch: **600-V ac**; UL 98 and NEMA KS 1; horsepower rated, lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- D. Interlocking Linkage: Provided between the receptacle and switch mechanism to prevent inserting or removing plug while switch is in the on position, inserting any plug other than specified, and turning switch on if an incorrect plug is inserted or correct plug has not been fully inserted into the receptacle.
- E. Receptacle: Polarized, three-phase, four-wire receptacle (fourth wire connected to enclosure ground lug).

#### 2.4 SHUNT TRIP SWITCHES (IF REQ)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide **product indicated on Drawings** or comparable product by one of the following:
1. Cooper Bussmann, Inc.
  2. Ferraz Shawmut, Inc.
  3. Littelfuse, Inc.
- B. General Requirements: Comply with[ **ASME A17.1,**] UL 50, and UL 98, with 200-kA interrupting and short-circuit current rating when fitted with Class J fuses.
- C. Switches: Three-pole, horsepower rated, with integral shunt trip mechanism and Class J fuse block; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- D. Accessories:
1. Oiltight key switch for key-to-test function.
  2. Oiltight **[red] [green] [white] [yellow]** ON pilot light.
  3. Isolated neutral lug; **100** percent rating.
  4. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
  5. Form C alarm contacts that change state when switch is tripped.
  6. Three-pole, double-throw, fire-safety and alarm relay; **[120-V ac] [24-V dc]** coil voltage.

## 2.5 MOLDED-CASE CIRCUIT BREAKERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide **product indicated on Drawings** or comparable product by one of the following:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.
- B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- E. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
  - 1. Instantaneous trip.
  - 2. Long- and short-time pickup levels.
  - 3. Long- and short-time time adjustments.
  - 4. Ground-fault pickup level, time delay, and  $I^2t$  response.
- F. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- G. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.
- H. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- I. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).
- J. Features and Accessories:
  - 1. Standard frame sizes, trip ratings, and number of poles.
  - 2. Lugs: **Mechanical** type, suitable for number, size, trip ratings, and conductor material.
  - 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.

4. Ground-Fault Protection: Comply with UL 1053; **integrally mounted, self-powered** type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Communication Capability: **Circuit-breaker-mounted** communication module with functions and features compatible with power monitoring and control system, specified in Division 26 Section "Electrical Power Monitoring and Control."
6. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
7. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
8. Auxiliary Contacts: **Two SPDT switches** with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
9. Alarm Switch: One **[NC]** contact that operates only when circuit breaker has tripped.
10. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
11. Zone-Selective Interlocking: Integral with **[electronic]** trip unit; for interlocking ground-fault protection function.
12. Electrical Operator: Provide remote control for on, off, and reset operations.
13. Accessory Control Power Voltage: **[Integrally mounted, self-powered]** [

## 2.6 MOLDED-CASE SWITCHES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide **product indicated on Drawings** or comparable product by one of the following:
  1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  3. Siemens Energy & Automation, Inc.
  4. Square D; a brand of Schneider Electric.
- B. General Requirements: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.
- C. Features and Accessories:
  1. Standard frame sizes and number of poles.
  2. Lugs: **Mechanical** type, suitable for number, size, trip ratings, and conductor material.
  3. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
  4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
  5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
  6. Auxiliary Contacts: **Two SPDT switches** with "a" and "b" contacts; "a" contacts mimic switch contacts, "b" contacts operate in reverse of switch contacts.
  7. Alarm Switch: One **NO** contact that operates only when switch has tripped.



8. Key Interlock Kit: Externally mounted to prohibit switch operation; key shall be removable only when switch is in off position.
9. Zone-Selective Interlocking: Integral with ground-fault shunt trip unit; for interlocking ground-fault protection function.
10. Electrical Operator: Provide remote control for on, off, and reset operations.
11. Accessory Control Power Voltage: **Integrally mounted, self-powered**

## 2.7 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
  1. Indoor, Dry and Clean Locations: NEMA 250, **Type 1**
  2. Outdoor Locations: NEMA 250, **Type 3R** [Kitchen] [Wash-Down] Areas: NEMA 250, **[Type 4X] <Insert type>, [stainless steel]**
  3. Other Wet or Damp, Indoor Locations: NEMA 250, **Type 4**
  4. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
  5. Hazardous Areas Indicated on Drawings: NEMA 250, **[Type 7] [Type 9]**

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Install fuses in fusible devices.
- E. Comply with NECA 1.

### 3.3 IDENTIFICATION

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."
  - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
  - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

### 3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges

END OF SECTION 262816

## **SECTION 265119 – INTERIOR LED LIGHTING**

### **PART 1. GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Interior solid-state luminaires that use LED technology.
  - 2. Lighting fixture supports.
- B. Related Requirements:
  - 1. Section 260500 – General Requirements
  - 2. Section 260519 – Low Voltage Electrical Power Conductors and Cables (600 Volts and Below).
  - 3. Section 260526 – Grounding and Bonding for Electrical Systems.

#### **1.3 DEFINITIONS**

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

#### **1.4 ACTION SUBMITTALS**

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

1. Arrange in order of luminaire designation.
  2. Include data on features, accessories, and finishes.
  3. Include physical description and dimensions of luminaires.
  4. Include emergency lighting units, including batteries and chargers.
  5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
  6. Photometric data and adjustment factors based on laboratory tests , complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project [IES LM-79] [and] [IES LM-80].
    - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
    - b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
- B. Shop Drawings: For nonstandard or custom luminaires.
1. Include plans, elevations, sections, and mounting and attachment details.
  2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  3. Include diagrams for power, signal, and control wiring.
- C. Product Schedule: For luminaires and lamps.[ **Use same designations indicated on Drawings.**]

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Lighting luminaires.
  2. Suspended ceiling components.
  3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches (300 mm) of the plane of the luminaires.
  4. Structural members to which **[equipment] [and] [or]** luminaires will be attached.
  5. Initial access modules for acoustical tile, including size and locations.
  6. Items penetrating finished ceiling, including the following:
    - a. Other luminaires.
    - b. Air outlets and inlets.
    - c. Speakers.
    - d. Sprinklers.
    - e. Access panels.
    - f. Ceiling-mounted projectors.

7. Moldings.

- B. Qualification Data: For testing laboratory providing photometric data for luminaires.
- C. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Product Certificates: For each type of luminaire.
- E. Product Test Reports: For each luminaire, for tests performed by **[manufacturer and witnessed by a qualified testing agency] [a qualified testing agency]**.
- F. Sample warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
  - 1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Lamps: 1 for every 100 of each type and rating installed. Furnish at least one of each type.
  - 2. Diffusers and Lenses: **One for every 100** of each type and rating installed. Furnish at least one of each type.
  - 3. Globes and Guards: **One for every 20** of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.
- C. Provide luminaires from a single manufacturer for each luminaire type.

- D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

#### 1.10 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: 1 year (12 months) from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 Light Fixtures

- A. Shall conform to the drawings and fixture schedule, NEC article 410 and to UL-57, “Electrical Lighting Fixtures”.

#### 2.2 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. Recessed Fixtures: Comply with NEMA LE 4.
- D. Bulb shape complying with ANSI C79.1.
- E. Lamp base complying with [ANSI C81.61] [or] [IEC 60061-1].
- F. CRI of minimum 85. CCT of [3500 K].
- G. Rated lamp life of [50,000].
- H. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- I. Integral driver.

- J. Nominal Operating Voltage: **[277 V ac but varies per fixture]**.
  - 1. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
- K. Housings:
  - 1. **[Extruded-aluminum]** housing and heat sink.
  - 2. **White painted** finish unless otherwise indicated.

## 2.3 CYLINDER

Retain this article for exposed, wall-mounted luminaires, used for direct or indirect lighting.

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Williams.
  - 2. Cooper Lighting.
  - 3. Metalux
  - 4. Focal Point.
  - 5. Tech Lighting.
- B. Minimum 500 to 8000 lumens. Minimum allowable efficacy of **[80]** lumens per watt.
- C. With integral mounting provisions.

## 2.4 DOWNLIGHT

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Williams.
  - 2. Cooper Lighting.
  - 3. Edge Lighting.
  - 4. Focal Point LLC.
  - 5. Pure Lighting.
  - 6. RAB Lighting.
- B. Minimum **[1,000]** lumens. Minimum allowable efficacy of **[80]** lumens per watt.
- C. Universal mounting bracket.
- D. Integral junction box with conduit fittings.

2.5 RECESSED LINEAR

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Williams.
  - 2. Cooper Lighting.
  - 3. Focal Point LLC.
  - 4. Neo-Ray
- B. Minimum [**2,000**] lumens. Minimum allowable efficacy of [**85**] lumens per watt.
- C. Integral junction box with conduit fittings.

2.6 STRIP LIGHT

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cooper Lighting.
  - 2. **Williams.**
  - 3. **Accliam**
- B. Minimum 5000 lumens per 4'-0" section. Minimum allowable efficacy of 90 lumens per watt.
- C. Integral junction box with conduit fittings.
- D. Integral junction box with conduit fittings.

2.7 SUSPENDED, NONLINEAR

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Tech Lighting.
  - 2. Cooper Lighting.
  - 3. Edge Lighting.
  - 4. Focal Point LLC.
- B. Minimum [**1,000**] lumens. Minimum allowable efficacy of [**85**] lumens per watt.
- C. Integral junction box with conduit fittings.



## 2.8 TAPE LIGHT

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Acclaim Lighting.
  - 2. Contech Lighting
- B. Minimum 200 lumens per foot. Minimum 2 watts per foot.
- C. Rated power supply and connector fittings.
- D. Aluminum mounting channel.

## 2.9 MATERIALS

- A. Metal Parts:
  - 1. Free of burrs and sharp corners and edges.
  - 2. Sheet metal components shall be steel unless otherwise indicated.
  - 3. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- C. Diffusers and Globes:
  - 1. **[prismatic acrylic] [clear, UV-stabilized acrylic]**
  - 2. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- D. Housings:
  - 1. Metal housing and heat sink.
  - 2. White **[painted]** finish.
- E. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
  - 1. Label shall include the following lamp characteristics:
    - a. "USE ONLY" and include specific lamp type.
    - b. Lamp diameter, shape, size, wattage, and coating.
    - c. CCT and CRI for all luminaires.

2.10 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.11 LUMINAIRE FIXTURE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, [**12 gage (2.68 mm)**]
- D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

- A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

- C. Install lamps in each luminaire.
- D. Supports:
  - 1. Sized and rated for luminaire weight.
  - 2. Able to maintain luminaire position after cleaning and relamping.
  - 3. Provide support for luminaire without causing deflection of ceiling or wall.
  - 4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.
- E. Flush-Mounted Luminaire Support:
  - 1. Secured to outlet box.
  - 2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
  - 3. Trim ring flush with finished surface.
- F. Wall-Mounted Luminaire Support:
  - 1. **[Attached to structural members in walls]**
  - 2. Do not attach luminaires directly to gypsum board.
- G. Ceiling-Mounted Luminaire Support:
  - 1. Ceiling mount with minimum two 5/32-inch- diameter aircraft cable supports adjustable to 120 inches in length.
  - 2. Ceiling mount with pendant mount with 5/32-inchdiameter aircraft cable supports adjustable to 120 inches in length
  - 3. Ceiling mount with hook mount.
- H. Suspended Luminaire Support:
  - 1. Pendants and Rods: Where longer than 48 inches brace to limit swinging.
  - 2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
  - 3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and **[tubing or rod] [wire support]** for suspension for each unit length of luminaire chassis, including one at each end.
  - 4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- I. Ceiling-Grid-Mounted Luminaires:
  - 1. Secure to any required outlet box.
  - 2. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

- J. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

#### 3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

#### 3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
  - 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

#### 3.6 ADJUSTING

Verify with Owner that adjusting service is required for Project.

- A. Occupancy Adjustments: When requested within [12] months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to [two] visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
  - 1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
  - 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
  - 3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 265119

## **SECTION 283111 - FIRE DETECTION AND ALARM SYSTEM**

### **ENGINEERING SPECIFICATION**

### **INTELLIGENT FIRE ALARM DETECTION SYSTEM WITH INTEGRATED AUDIO**

#### **PART 1 GENERAL**

##### **A. New Rooms shall be integrated into existing fire alarm system**

#### **1.1 RELATED SECTIONS**

##### **A. Section 211313 - Fire Suppression**

#### **1.2 DESCRIPTION: New Fire alarm elements shall be fully integrated into existing system. New elements shall conform to this Spec**

- A.** This section of the specification includes the furnishing, installation, and connection of an intelligent reporting, microprocessor controlled, addressable, fire detection and emergency voice alarm communication system. It shall include, but not be limited to, alarm initiating devices, alarm notification appliances, control panels, auxiliary control devices, annunciators, power supplies, and wiring as shown on the drawings and specified herein. The system equipment shall be equal to Notifier, Edwards, or approved equal.
- B.** The fire alarm system shall comply with requirements of NFPA Standard 72 for Protected Premises Signaling Systems except as modified and supplemented by this specification. The system shall be electrically supervised and monitor the integrity of all conductors.
- C.** The system shall be an active/interrogative type system where each addressable device is repetitively scanned, causing a signal to be transmitted to the main fire alarm control panel (FACP) indicating that the device and its associated circuit wiring is functional. Loss of this signal at the main FACP shall result in a trouble indication as specified hereinafter for the input.
- D.** The facility shall have an emergency voice alarm communication system. Digitally stored message sequences shall notify the building occupants that a fire or life safety condition has been reported. Message generator(s) shall be capable of automatically distributing up to eight (8) simultaneous, unique messages to appropriate audio zones within the facility based on the type and location of the initiating event. Provide a two-channel system for this project, one for the fire zone and one for the rest of the building. The Fire Command Center (FCC) shall also support Emergency manual voice announcement capability for both system wide or selected audio zones and shall include provisions for the system operator to override automatic messages system wide or in selected zones.
- E.** The fire alarm system shall be manufactured by an ISO 9001 certified company and meet the requirements of BS EN9001: ANSI/ASQC Q9001-1994.
- F.** The system and its components shall be Underwriters Laboratories, Inc. listed under the appropriate UL testing standard as listed herein for fire alarm applications and the installation shall be in compliance with the UL listing.
- I.** The equipment providing company shall employ NICET (minimum Level II Fire Alarm Technology) technicians on site to guide the final check-out and to ensure the systems integrity. The system in house engineering and design staff shall employ NICET 4 technicians.

#### **1.3 SCOPE: New fire alarm shall be fully integrated into existing system.**

- A. A new intelligent reporting, microprocessor-controlled fire detection system shall be installed in accordance with the specifications and drawings.
- B. The system shall be designed such that each signaling line circuit (SLC) is limited to only 80% of its total capacity at initial installation.
- C. Basic Performance:
  - 1. Alarm, trouble and supervisory signals from all intelligent reporting devices shall be encoded on NFPA Style 4 (Class B) Signaling Line Circuits (SLC).
  - 2. Initiation Device Circuits (IDC) shall be wired Class B as part of an addressable device connected by the SLC Circuit.
  - 3. Notification Appliance Circuits (NAC) shall be wired Class B as part of an addressable device connected by the SLC Circuit.
  - 4. Alarm signals arriving at the FACP shall not be lost following a primary power failure (or outage) until the alarm signal is processed and recorded.
  - 5. Notification Appliance Circuits (NAC) speaker circuits shall be arranged such that there is a minimum of one speaker circuit per zone of the building or smoke zone whichever is greater.
  - 6. Audio amplifiers and tone generating equipment shall be electrically supervised for normal and abnormal conditions.
  - 7. Notification Appliance Circuits (NAC) speaker circuits and control equipment shall be arranged such that loss of any one (1) speaker circuit will not cause the loss of any other speaker circuit in the system.
  - 8. Two-way emergency telephone communication circuits shall be supervised for open and short circuit conditions.
  - 9. Speaker circuits shall be arranged such that there is a minimum of one speaker circuit per smoke zone.
  - 10. Speaker circuits shall be electrically supervised for open and short circuit conditions. If a short circuit exists on a speaker circuit, it shall not be possible to activate that circuit.
  - 11. Audio amplifiers and tone generating equipment shall be electrically supervised for abnormal conditions.
  - 12. The system shall be wired for survivability per NFPA.
- D. Basic System Functional Operation

When a fire alarm condition is detected and reported by one of the system initiating devices, the following functions shall immediately occur:

- 1. The System Alarm LED shall flash.
- 2. A local piezo electric signal in the control panel shall sound.
- 3. The 640-character LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
- 4. History storage equipment shall log the information associated each new fire alarm control panel condition, along with time and date of occurrence.
- 5. All system output programs assigned via control-by-event interlock programming to be activated by the particular point in alarm shall be executed, and the associated system outputs (notification appliances and/or relays) shall be activated including:
  - Air handling equipment shutdown within each evacuation zone.
  - Door holder release within each evacuation zone.
  - All information shall be displayed at the network annunciators.
  - Activate digital alarm communicator equipment for fire department connection.

6. The audio portion of the system shall sound the proper audio signal (consisting of tone, voice, or tone and voice) to the appropriate zones. One message depicting an “Alarm Condition” shall be sent to the entire bldg. Message content shall be approved by the owner and Fire Marshal prior to installing.

#### 1.4 SUBMITTALS

##### A. General:

1. All submittals shall be submitted to the Architect/Engineer for review.
2. All references to manufacturer’s model numbers and other pertinent information herein is intended to establish minimum standards of performance, function and quality.

##### B. Shop Drawings:

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
2. Include manufacturer’s name(s), model numbers, ratings, power requirements, equipment layout, device arrangement, complete wiring point-to-point diagrams, and conduit layouts.
3. Show annunciator layout, configurations, and terminations.

##### C. Manuals:

1. Submit simultaneously with the shop drawings, complete operating and maintenance manuals listing the manufacturer’s name(s), including technical data sheets.
2. Wiring diagrams shall indicate internal wiring for each device and the interconnections between the items of equipment.
3. Provide a clear and concise description of operation that gives, in detail, the information required to properly operate the equipment and system.
4. Approvals will be based on complete submissions of manuals together with shop drawings.

##### D. Certifications:

Together with the shop drawing submittal, submit a certification from the major equipment manufacturer indicating that the proposed supervisor of the installation and the proposed performer of contract maintenance is an authorized representative of the major equipment manufacturer. Include names and addresses in the certification. Provide NICET certifications as required.

#### 1.5 GUARANTY:

All work performed and all material and equipment furnished under this contract shall be free from defects and shall remain so for a period of at least one (1) year from the date of acceptance. The full cost of maintenance, labor and materials required to correct any defect during this one year period shall be included in the submittal bid.

#### 1.6 APPLICABLE PUBLICATIONS:

The publications listed below form a part of this specification. The publications are referenced in text by the basic designation only.

##### A. National Fire Protection Association (NFPA) - USA:

No. 70 National Electric Code (NEC)  
No. 72-2007 National Fire Alarm Code  
No. 92A Smoke Control Systems

B. Underwriters Laboratories Inc. (UL) - USA:

- No. 50 Cabinets and Boxes
- No. 268 Smoke Detectors for Fire Protective Signaling Systems
- No. 864 Control Units for Fire Protective Signaling Systems
- No. 268A Smoke Detectors for Duct Applications.
- No. 521 Heat Detectors for Fire Protective
- No. 228 Door Closers-Holders for Fire Protective Signaling Systems.
- No. 464 Audible Signaling Appliances.
- No. 38 Manually Actuated Signaling Boxes.
- No. 346 Waterflow Indicators for Fire Protective Signaling Systems.
- No. 1481 Power supplies for Fire Protective Signaling Systems.
- No. 1076 Control Units for Burglar Alarm Proprietary Protective Signaling Systems.
- No. 1971 Visual Notification Appliances.

C. 2012 IBC.

D. All requirements of the Authority Having Jurisdiction (AHJ).

1.7 APPROVALS:

A. The system shall have proper listing and/or approval from the following nationally recognized agencies:

UL Underwriters Laboratories Inc

PART 2.0 PRODUCTS

2.1 EQUIPMENT AND MATERIAL, GENERAL:

- A. All equipment and components shall be new, and the manufacturer's current model. The materials, appliances, equipment and devices shall be tested and listed by a nationally recognized approvals agency for use as part of a protected premises protective signaling (fire alarm) system. The authorized representative of the manufacturer of the major equipment, such as control panels, shall be responsible for the satisfactory installation of the complete system.
- B. All equipment and components shall be installed in strict compliance with each manufacturer's recommendations. Consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc. before beginning system installation. Refer to the riser/connection diagram for all specific system installation/termination/wiring data.
- C. All equipment shall be attached to walls and ceiling/floor assemblies and shall be held firmly in place (e.g., detectors shall not be supported solely by suspended ceilings). Fasteners and supports shall be adequate to support the required load.

2.2 CONDUIT AND WIRE:

A. Conduit:

- 1. Conduit shall be in accordance with The National Electrical Code (NEC), local and state requirements.



2. All wiring shall be installed in conduit or raceway in mechanical and electrical rooms or where exposed. Conduit fill shall not exceed 40 percent of interior cross sectional area where three or more cables are contained within a single conduit.
3. Cable must be separated from any open conductors of Power, or Class 1 circuits, and shall not be placed in any conduit, junction box or raceway containing these conductors, as per NEC Article 760-29.
4. Wiring for 24 volt control, alarm notification, emergency communication and similar power-limited auxiliary functions may be run in the same conduit as initiating and signaling line circuits. All circuits shall be provided with transient suppression devices and the system shall be designed to permit simultaneous operation of all circuits without interference or loss of signals.
5. Conduit shall not enter the fire alarm control panel, or any other remotely mounted control panel equipment or back-boxes, except where conduit entry is specified by the FACP manufacturer.
6. Conduit shall be 3/4 inch (19.1 mm) minimum.

B. Wire

1. All fire alarm system wiring must be new.
2. Wiring shall be in accordance with local, state and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 18 AWG (1.02 mm) for initiating device circuits and signaling line circuits, and 14 AWG (1.63 mm) for notification appliance circuits.
3. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.
4. Wire and cable not installed in conduit shall have a fire resistance rating suitable for the installation as indicated in NFPA 70 (e.g., FPLR).
5. The system shall permit the use of IDC and NAC wiring in the same conduit with the multiplex communication loop.
6. All field wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, removal of any internal modules, or any open circuits in the field wiring; a trouble signal will be activated until the system and its associated field wiring are restored to normal condition.
7. All voice speaker and analog telephone circuits shall use twisted/shielded pair to eliminate cross talk.

C. Terminal Boxes, Junction Boxes and Cabinets:

All boxes and cabinets shall be UL listed for their intended purpose.

- D. The fire alarm control panel shall be connected to a separate dedicated branch circuit, maximum 20 amperes. This circuit shall be labeled at the main power distribution panel as FIRE ALARM. Fire alarm control panel primary power wiring shall be 12 AWG. The control panel cabinet shall be grounded securely to either a cold water pipe or grounding rod.

2.3 MAIN FIRE ALARM CONTROL PANEL(existing)

- A. The main FACP Central Console shall be a NOTIFIER Model NFS2-3030 and shall contain a microprocessor based Central Processing Unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent addressable smoke and thermal (heat) detectors, addressable modules, control circuits, and notification appliance circuits, annunciators, and other system controlled devices.
- B. In conjunction with intelligent Loop Control Modules and Loop Expander Modules, the main FACP shall perform the following functions:

1. Supervise and monitor all intelligent addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.
2. Supervise all initiating signaling and notification circuits throughout the facility by way of connection to addressable monitor and control modules.
3. Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed. In the event of CPU failure, all SLC loop modules shall fallback to degrade mode. Such degrade mode shall treat the corresponding SLC loop control modules and associated detection devices as conventional two-wire operation. Any activation of a detector in this mode shall automatically activate associated Notification Appliance Circuits.
4. Visually and audibly annunciate any trouble, supervisory, security or alarm condition on operator's terminals, panel display, and annunciators.
5. When a fire alarm condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
  - a. The system alarm LED shall flash.
  - b. A local piezo-electric audible device in the control panel shall sound a distinctive signal.
  - c. The 640-character backlit LCD display shall indicate all information associated with the fire alarm condition, including the type of alarm point and its location within the protected premises.
  - d. History storage equipment shall log and the event information along with a time and date stamp.
  - e. All system outputs assigned via preprogrammed equations for a particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.
  - f. When a trouble condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
    - g. The system trouble LED shall flash.
    - h. A local piezo-electric audible device in the control panel shall sound a distinctive signal.
    - i. The 640-character backlit LCD display shall indicate all information associated with the trouble condition, including the type of trouble point and its location within the protected premises.
    - j. History storage equipment shall log the event information along with a time and date stamp.
    - k. All system outputs assigned via preprogrammed equations for a particular point in trouble shall be executed, and the associated system outputs (trouble notification appliances and/or relays) shall be activated.
6. When a supervisory condition is detected and reported by one of the system initiating devices or appliances, the following functions shall immediately occur:
  - a. The system trouble LED shall flash.
  - b. A local piezo-electric audible device in the control panel shall sound a distinctive signal.
  - c. The 640-character backlit LCD display shall indicate all information associated with the supervisory condition, including the type of trouble point and its location within the protected premises.
  - d. History storage equipment shall log the event information along with a time and date stamp.
  - e. All system outputs assigned via preprogrammed equations for a particular point in trouble shall be executed, and the associated system outputs (notification appliances and/or relays) shall be activated.

C. Operator Control

1. Acknowledge Switch:
  - a. Activation of the control panel acknowledge switch in response to new alarms and/or troubles shall silence the local panel piezo electric signal and change the alarm and trouble LEDs from

- flashing mode to steady-ON mode. If multiple alarm or trouble conditions exist, depression of this switch shall advance the LCD display to the next alarm or trouble condition. In addition, the FACP shall support Block Acknowledge to allow multiple trouble conditions to be acknowledged with a single depression of this switch.
    - b. Depression of the Acknowledge switch shall also silence all remote annunciator piezo sounders.
  - 2. Signal Silence Switch:
    - a. Depression of the Signal Silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition. The selection of notification circuits and relays that are silence able by this switch shall be fully field programmable within the confines of all applicable standards. The FACP software shall include silence inhibit and auto-silence timers.
  - 3. Drill Switch:
    - a. Depression of the Drill switch shall activate all programmed notification appliance circuits. The drill function shall latch until the panel is silenced or reset.
  - 4. System Reset Switch:
    - a. Depression of the System Reset switch shall cause all electronically latched initiating devices to return to their normal condition. Initiating devices shall re-report if active. Active notification appliance circuits shall not silence upon Reset. Systems that de-activate and subsequently re-activate notification appliance circuits shall not be considered equal. All programmed Control-By-Event equations shall be re-evaluated after the reset sequence is complete if the initiating condition has cleared. Non-latching trouble conditions shall not clear and re-report upon reset.
  - 5. Lamp Test:
    - a. The Lamp Test switch shall activate all local system LEDs, light each segment of the liquid crystal display and display the panel software revision for service personal.
  - 6. Scroll Display Keys:
    - a. There shall be Scroll Display keys for FIRE ALARM, SECURITY, SUPERVISORY, TROUBLE, and OTHER EVENTS. Depression of the Scroll Display key shall display the next event in the selected queue allowing the operator to view events by type.
  - 7.
- D. System Capacity and General Operation
  - 1. The control panel shall be capable of expansion via up to 10 SLC modules. Each module shall support a maximum of 318 analog/addressable devices for a maximum system capacity of 3180 points. The system shall be capable of 3072 annunciation points per system regardless of the number of addressable devices.
  - 2. The Fire Alarm Control Panel shall include a full featured operator interface control and annunciation panel that shall include a backlit 640-character liquid crystal display, individual, color coded system status LEDs, and a QWERTY style alphanumeric keypad for the field programming and control of the fire alarm system. Said LCD shall also support graphic bit maps capable of displaying the company name and logo of either the owner or installing company.
  - 3. All programming or editing of the existing program in the system shall be achieved without special equipment and without interrupting the alarm monitoring functions of the fire alarm control panel.

4. The FACP shall be able to provide the following software and hardware features:
  - a. Pre-signal and Positive Alarm Sequence: The system shall provide means to cause alarm signals to only sound in specific areas with a delay of the alarm from 60 to up to 180 seconds after start of alarm processing. In addition, a Positive Alarm Sequence selection shall be available that allows a 15-second time period for acknowledging an alarm signal from a fire detection/initiating device. If the alarm is not acknowledged within 15 seconds, all local and remote outputs shall automatically activate immediately.
  - b. Smoke Detector Pre-alarm Indication at Control Panel: To obtain early warning of incipient or potential fire conditions, the system shall support a programmable option to determine system response to real-time detector sensing values above the programmed setting. Two levels of Pre-alarm indication shall be available at the control panel: alert and action.
  - c. Alert: It shall be possible to set individual smoke detectors for pre-programmed pre-alarm thresholds. If the individual threshold is reached, the pre-alarm condition shall be activated.
  - d. Action: If programmed for Action and the detector reaches a level exceeding the pre-programmed level, the control panel shall indicate an action condition. Sounder bases installed with either heat or smoke detectors shall automatically activate on action Pre-Alarm level, with general evacuation on Alarm level.
  - e. The system shall support a detector response time to meet world annunciation requirements of less than 3 seconds.
  - f. Device Blink Control: Means shall be provided to turn off detector/module LED strobes for special areas.
  - g. NFPA 72 Smoke Detector Sensitivity Test: The system shall provide an automatic smoke detector test function that meets the requirements of NFPA 72.
  - h. Programmable Trouble Reminder: The system shall provide means to automatically initiate a reminder that troubles exist in the system. The reminder will appear on the system display and (if enabled) will sound a piezo alarm.
  - i. On-line or Off-line programming: The system shall provide means to allow panel programming either through an off-line software utility program away from the panel or while connected and on-line. The system shall also support upload and download of programmed database and panel executive system program to a Personal Computer/laptop.
  - j. History Events: The panel shall maintain a history file of the last 4000 events, each with a time and date stamp. History events shall include all alarms, troubles, operator actions, and programming entries. The control panels shall also maintain a 1000 event Alarm History buffer, which consists of the 1000 most recent alarm events from the 4000 event history file.
  - k. Smoke Control Modes: The system shall provide means to perform FSCS mode Smoke Control to meet NFPA-92A and 90B and HVAC mode to meet NFPA 90A.
  - l. The system shall provide means for all SLC devices on any SLC loop to be auto programmed into the system by specific address. The system shall recognize specific device type ID's and associate that ID with the corresponding address of the device.
  - m. Drill: The system shall support means to activate all silence-able fire output circuits in the event of a practice evacuation or "drill". If enabled for local control, the front panel switch shall be held for a minimum of 2 seconds prior to activating the drill function.
  - n. Passwords and Users: The system shall support two password levels, master and user. Up to 9 user passwords shall be available, each of which may be assigned access to the programming change menus, the alter status menus, or both. Only the master password shall allow access to password change screens.
  - o. Two Wire Detection: The system shall support standard two wire detection devices specifically all models of System Sensor devices, Fenwal PDS-7125/7126 and CPD-7021, Hochiki model SLK-24F/24FH, Edwards 6250B/6270B and 6264B and Simplex models 2098-9201/9202 and 9576.
  - p. Block Acknowledge: The system shall support a block Acknowledge for Trouble Conditions
  - q. Sensitivity Adjust: The system shall provide Automatic Detector Sensitivity Adjust based on Occupancy schedules including a Holiday list of up to 15 days.

- r. Environmental Drift Control: The system shall provide means for setting Environmental Drift Compensation by device. When a detector accumulates dust in the chamber and reaches an unacceptable level but yet still below the allowed limit, the control panel shall indicate a maintenance alert warning. When the detector accumulates dust in the chamber above the allowed limit, the control panel shall indicate a maintenance urgent warning.
- s. Custom Action Messages: The system shall provide means to enter up to 100 custom action messages of up to 160 characters each. It shall be possible to assign any of the 100 messages to any point.
- t. Print Functions: The system shall provide means to obtain a variety of reports listing all event, alarm, trouble, supervisory, or security history. Additional reports shall be available for point activation for the last Walk Test performed, detector maintenance report containing the detector maintenance status of each installed addressable detector, all network parameters, all panel settings including broad cast time, event ordering, and block acknowledge, panel timer values for Auto Silence, Silence Inhibit, AC Fail Delay time and if enabled, Proprietary Reminder, and Remote Reminder timers, supervision settings for power supply and printers, all programmed logic equations, all custom action messages, all non-fire and output activations (if pre-programmed for logging) all active points filtered by alarms only, troubles only, supervisory alarms, pre-alarms, disabled points and activated points, all installed points filtered by SLC points, logic zones, annunciators, releasing zones, special zones, and trouble zones. (printer not part of this contract).
- u. Local Mode: If communication is lost to the central processor the system shall provide added survivability through the intelligent loop control modules. Inputs from devices connected to the SLC and loop control modules shall activate outputs on the same loop when the inputs and outputs have been set with point programming to participate in local mode or when the type codes are of the same type: that is, an input with a fire alarm type code shall activate an output with a fire alarm type code.
- v. Resound based on type for security or supervisory: The system shall indicate a Security alarm when a monitor module point programmed with a security Type Code activates. If silenced alarms exist, a Security alarm will Resound the panel sounder. The system shall indicate a Supervisory alarm when a monitor module point programmed with a supervisory Type Code activates. If there are silenced alarms, a Supervisory alarm will Resound the panel sounder.
- w. Read status preview - enabled and disabled points: Prior to re-enabling points, the system shall inform the user that a disabled device is in the alarm state. This shall provide notice that the device must be reset before the device is enabled thereby avoiding activation of the notification circuits.
- x. Custom Graphics: When fitted with an LCD display, the panel shall permit uploading of a custom bit-mapped graphic to the display screen.
- y. Multi-Detector and Cooperating Detectors: The system shall provide means to link one detector to up to two detectors at other addresses on the same loop in cooperative multi-detector sensing. There shall be no requirement for sequential addresses on the detectors and the alarm event shall be a result or product of all cooperating detectors chamber readings.
- z. Tracking/Latching Duct (ion and photo): The system shall support both tracking and latching duct detectors either ion or photo types.
- aa. ACTIVE EVENT: The system shall provide a Type ID called FIRE CONTROL for purposes of air-handling shutdown, which shall be intended to override normal operating automatic functions. Activation of a FIRE CONTROL point shall cause the control panel to (1) initiate the monitor module Control-by-Event, (2) send a message to the panel display, history buffer and annunciators, (3) shall not light an indicator at the control panel, (4) Shall display ACTIVE on the LCD as well as display a FIRE CONTROL Type Code and other information specific to the device.
- bb. NON-FIRE Alarm Module Reporting: A point with a type ID of NON-FIRE shall be available for use for energy management or other non-fire situations. NON-FIRE point operation shall not affect control panel operation nor shall it display a message at the panel LDC. Activation of a

- NON-FIRE point shall activate control by event logic but shall not cause any indication on the control panel.
- cc. Security Monitor Points: The system shall provide means to monitor any point as a type security.
  - dd. One-Man Walk Test: The system shall provide both a basic and advanced walk test for testing the entire fire alarm system. The basic walk test shall allow a single operator to run audible tests on the panel. All logic equation automation shall be suspended during the test and while annunciators can be enabled for the test, all shall default to the disabled state. During an advanced walk test, field-supplied output point programming will react to input stimuli such as CBE and logic equations. When points are activated in advanced test mode, each initiating event shall latch the input. The advanced test shall be audible and shall be used for pull station verification, magnet activated tests on input devices, input and output device and wiring operation/verification.
  - ee. Control By Event Functions: CBE software functions shall provide means to program a variety of output responses based on various initiating events. The control panel shall operate CBE through lists of zones. A zone shall become listed when it is added to a point’s zone map through point programming. Each input point such as detector, monitor module or panel circuit module shall support listing of up to 10 zones into its programmed zone map.
  - ff. Permitted zone types shall be general zone, releasing zone and special zone. Each output point (control module, panel circuit module) can support a list of up to 10 zones including general zone, logic zone, releasing zone and trouble zone. It shall be possible for output points to be assigned to list general alarm. Non-Alarm or Supervisory points shall not activate the general alarm zone.
  - gg. 1000 General Zones: The system shall support up to 1000 general purpose software zones for linking inputs to outputs. When an input device activates, any general zone programmed into that device’s zone map will be active and any output device that has an active general zone in its map will be active. It shall also be possible to use general zone as arguments in logic equations.
  - hh. 1000 Logic Equations: The system shall support up to 1000 logic equations for AND, OR, NOT, ONLY1, ANYX, XZONE or RANGE operators that allow conditional I/O linking. When any logic equation becomes true, all output points mapped to the logic zone shall activate.
  - ii. 10 trouble equations per device: The system shall provide support for up to 10 trouble equations for each device, which shall permit programming parameters to be altered, based on specific fault conditions. If the trouble equation becomes true, all output points mapped to the trouble zone shall activate.
  - jj. Control-By-Time: A time based logic function shall be available to delay an action for a specific period of time based upon a logic input with tracking feature. A latched version shall also be available. Another version of this shall permit activation on specific days of the week or year with ability to set and restore based on a 24 hour time schedule on any day of the week or year.
  - kk. Multiple agent releasing zones: The system shall support up to 10 releasing zones to protect against 10 independent hazards. Releasing zones shall provide up to three cross-zone and four abort options to satisfy any local jurisdiction requirements.
  - ll. Alarm Verification, by device, with timer and tally: The system shall provide a user-defined global software timer function that can be set for a specific detector or indicating panel module input. The timer function shall delay an alarm signal for a user-specified time period and the control panel shall ignore the alarm verification timer if another alarm is detected during the verification period. It shall also be possible to set a maximum verification count between 0 and 20 with the “0” setting producing no alarm verification. When the counter exceeds the threshold value entered, a trouble shall be generated to the panel.

E. Central Processing Unit

1. The Central Processing Unit shall communicate with, monitor, and control all other modules within the control panel. Removal, disconnection or failure of any control panel module shall be detected and reported to the system display by the Central Processing Unit.
2. The Central Processing Unit shall contain and execute all control-by-event (including Boolean functions including but not limited to AND, OR, NOT, ANYx, and CROSSZONE) programs for specific action to be taken if an alarm condition is detected by the system. Such control-by-event programs shall be held in non-volatile programmable memory, and shall not be lost with system primary and secondary power failure.
3. The Central Processing Unit shall also provide a real-time clock for time annotation, to the second, of all system events. The time-of-day and date shall not be lost if system primary and secondary power supplies fail.
4. The CPU shall be capable of being programmed on site without requiring the use of any external programming equipment. Systems that require the use of external programmers or change of EPROMs are not acceptable.
5. Consistent with UL864 standards, the CPU and associated equipment are to be protected so that voltage surges or line transients will not affect them.
6. Each peripheral device connected to the CPU shall be continuously scanned for proper operation. Data transmissions between the CPU and peripheral devices shall be reliable and error free. The transmission scheme used shall employ dual transmission or other equivalent error checking techniques.
7. The CPU shall provide an EIA-232 interface between the fire alarm control panel and the UL Listed Electronic Data Processing (EDP) peripherals.
8. The CPU shall provide two EIA-485 ports for the serial connection to annunciation and control subsystem components.
9. The EIA-232 serial output circuit shall be optically isolated to assure protection from earth ground.
10. The CPU shall provide one high-speed serial connection for support of network communication modules.
11. The CPU shall provide double pole relays for FIRE ALARM, SYSTEM TROUBLE, SUPERVISORY, and SECURITY. The SUPERVISORY and SECURITY relays shall provide selection for additional FIRE ALARM contacts.

F. Display

1. The system display shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters.
2. The display assembly shall contain, and display as required, custom alphanumeric labels for all intelligent detectors, addressable modules, and software zones.
3. The system display shall provide a 640-character backlit alphanumeric Liquid Crystal Display (LCD). It shall also provide ten Light-Emitting-Diodes (LEDs), that indicate the status of the following system parameters: AC POWER, FIRE ALARM, PREALARM, SECURITY, SUPERVISORY, SYSTEM TROUBLE, OTHER EVENT, SIGNALS SILENCED, POINT DISABLED, and CPU FAILURE.
4. The system display shall provide a QWERTY style keypad with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Two different password levels with up to ten (one Master and nine User) passwords shall be accessible through the display interface assembly to prevent unauthorized system control or programming.
5. The system display shall include the following operator control switches: ACKNOWLEDGE, SIGNAL SILENCE, RESET, DRILL, and LAMP TEST. Additionally, the display interface shall allow scrolling of events by event type including, FIRE ALARM, SECURITY, SUPERVISORY, TROUBLE, and OTHER EVENTS.

G. Loop (Signaling Line Circuit) Control Module:

1. The Loop Control Module shall monitor and control a minimum of 318 intelligent addressable devices. This includes 159 intelligent detectors (Ionization, Photoelectric, or Thermal) and 159 monitor or control modules.

2. The Loop Control Module shall contain its own microprocessor and shall be capable of operating in a local/degrade mode (any addressable device input shall be capable of activating any or all addressable device outputs) in the unlikely event of a failure in the main CPU.
  3. The Loop Control Module shall provide power and communicate with all intelligent addressable detectors and modules on a single pair of wires. This SLC Loop shall be capable of operating as a NFPA Style 6 (Class B) circuit.
  4. The SLC interface board shall be able to drive an NFPA Style 6 twisted unshielded circuit up to 12,500 feet in length. The SLC Interface shall also be capable of driving an NFPA Style 6, no twist, no shield circuit for limited distances determined by the manufacturer. In addition, SLC wiring shall meet the listing requirements for it to exit the building or structure. "T"-tapping shall be allowed in either case.
  5. The SLC interface board shall receive analog or digital information from all intelligent detectors and shall process this information to determine whether normal, alarm, or trouble conditions exist for that particular device. Each SLC Loop shall be isolated and equipped to annunciate an Earth Fault condition. The SLC interface board software shall include software to automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information may also be used for automatic detector testing and the automatic determination of detector maintenance requirements.
- H. Enclosures:
1. The control panel shall be housed in a UL-listed cabinet suitable for surface or semi-flush mounting. The cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish.
  2. The back box and door shall be constructed of 0.060 steel with provisions for electrical conduit connections into the sides and top.
  3. The door shall provide a key lock and include a transparent opening for viewing all indicators. For convenience, the door shall have the ability to be hinged on either the right or left-hand side.
  4. The control unit shall be modular in structure for ease of installation, maintenance, and future expansion.
- I. Digital Voice Command Center – Notifier DVC.
1. The Digital Voice Command Center located with the FACP, shall contain all equipment required for all audio control, emergency telephone system control, signaling and supervisory functions. This shall include speaker zone indication and control, telephone circuit indication and control, digital voice units, microphone and main telephone handset.
  2. Function: The Voice Command Center equipment shall perform the following functions:
    - a. Operate as a supervised multi-channel emergency voice communication system.
    - b. Operate as a two-way emergency telephone system control center.
    - c. Audibly and visually annunciate the active or trouble condition of every speaker circuit and emergency telephone circuit.
    - d. Audibly and visually annunciate any trouble condition for digital tone and voice units required for normal operation of the system.
    - e. Provide all-call Emergency Paging activities through activation of a single control switch.
    - f. As required, provide vectored paging control to specific audio zones via dedicated control switches.
    - g. Provide a factory recorded "library" of voice messages and tones in standard WAV. File format, which may be edited and saved on a PC running a current Windows® operating system.
    - h. Provide a software utility capable of off-line programming for the VCC operation and the audio message files. This utility shall support the creation of new programs as well as editing and



- saving existing program files. Uploading or downloading the VCC shall not inhibit the emergency operation of other nodes on the fire alarm network.
- i. Support an optional mode of operation with four analog audio outputs capable of being used with UL 864 fire-listed analog audio amplifiers and SCL controlled switching.
- j. The Digital Voice Command shall be modular in construction, and shall be capable of being field programmable without requiring the return of any components to the manufacturer and without requiring use of any external computers or other programming equipment.
- k. The Digital Voice Command and associated equipment shall be protected against unusually high voltage surges or line transients.

J. Power Supply: Notifier AMPS-24

1. The Addressable Main Power Supply shall operate on 120/240 VAC, 50/60 Hz, and shall provide all necessary power for the FACP.
2. The Addressable Main Power Supply shall provide the required power to the CPU using a switching 24 VDC regulator and shall incorporate a battery charger for 24 hours of standby power using dual-rate charging techniques for fast battery recharge.
3. The Addressable Main Power Supply shall provide a battery charger for 24 hours of standby using dual-rate charging techniques for fast battery recharge. The supply shall be capable of charging batteries ranging in capacity from 25-200 amp-hours within a 48-hour period.
4. The Addressable Main Power Supply shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults.
5. The Addressable Main Power Supply shall be power-limited per UL864 requirements.

K. System Circuit Supervision

1. The FACP shall supervise all circuits to intelligent devices, transponders, annunciators and peripheral equipment and annunciate loss of communication with these devices. The CPU shall continuously scan above devices for proper system operation and upon loss of response from a device shall sound an audible trouble, indicate which device or devices are not responding and store the information in the history buffer.
2. Transponders that lose communication with the CPU shall sound an audible trouble and light an LED indicating loss of communications.
3. Sprinkler system valves, standpipe control valves, PIV, and main gate valves shall be supervised for off-normal position.
4. All speaker and emergency phone circuits shall be supervised for opens and shorts. Each transponder speaker and emergency phone circuit shall have an individual ON/OFF indication (green LED).

L. Field Wiring Terminal Blocks

1. All wiring terminal blocks shall be the plug-in/removable type and shall be capable of terminating up to 12 AWG wire. Terminal blocks that are permanently fixed to the PC board are not acceptable.

M. Audio Amplifiers: Notifier AA series.

1. The Audio Amplifiers will provide Audio Power (@25 Volts RMS) for distribution to speaker circuits.
2. Multiple audio amplifiers may be mounted in a single enclosure, either to supply incremental audio power, or to function as an automatically switched backup amplifier(s).
3. The audio amplifier shall include an integral power supply, and shall provide built-in LED indicators for the following conditions:
  - Audio Amplifier Failure Detected Trouble
  - Active Alarm Bus input
  - Short circuit on speaker circuit 1

- Short circuit on speaker circuit 2
- Short circuit on speaker circuit 3
- Short circuit on speaker circuit 4
- Board failure
- Power supply Earth Fault
- Power supply 5V present
- Power supply conditions – Brownout, High Battery, Low Battery, Charger Trouble

4. The audio amplifier shall provide the following built-in controls:

- Signal Silence of communication loss annunciation Reset
- Level adjustment for background music
- Enable/Disable for Earth Fault detection

5. Adjustment of the correct audio level for the amplifier shall not require any special tools or test equipment.

N. Audio Message Generator (Prerecorded Voice)/Speaker Control:

1. Each initiating zone or intelligent device shall interface with an emergency voice communication system capable of transmitting a prerecorded voice message to all speakers in the building.
2. Actuation of any alarm initiating device shall cause a prerecorded message to sound over the speakers. The message shall be repeated four (4) times. Pre- and post-message tones shall be supported.
3. A built-in microphone shall be provided to allow paging through speaker circuits.
4. System paging from emergency telephone circuits shall be supported.
5. The audio message generator shall have the following indicators and controls to allow for proper operator understanding and control:

LED Indicators:

- Lamp Test
- Trouble
- Off-Line Trouble
- Microphone Trouble
- Phone Trouble
- Busy/Wait
- Page Inhibited
- Pre/Post Announcement Tone

O. Controls with associated LED Indicators:

1. Speaker Switches/Indicators

- a. The speaker circuit control switches/indicators shall include visual indication of active and trouble status for each speaker circuit in the system.
- b. The speaker circuit control panel shall include switches to manually activate or deactivate each speaker circuit in the system.

2. Emergency Two-Way Telephone Control Switches/Indicators

- a. The emergency telephone circuit control panel shall include visual indication of active and trouble status for each telephone circuit in the system.
- b. The telephone circuit control panel shall include switches to manually activate or deactivate each telephone circuit in the system.

P. System Expansion:

Design the main FACP and required components so that the system can be expanded in the future (to include the addition of twenty percent more circuits or zones) without disruption or replacement of the existing control panel. This shall include hardware capacity, software capacity and cabinet space.

I. Field Programming

1. The system shall be programmable, configurable and expandable in the field without the need for special tools, laptop computers, or other electronic interface equipment. There shall be no firmware changes required to field modify the system time, point information, equations, or annunciator programming/information.
2. It shall be possible to program through the standard FACP keyboard all system functions.
3. All field defined programs shall be stored in non-volatile memory.
4. Two levels of password protection shall be provided in addition to a key-lock cabinet. One level shall be used for status level changes such as point/zone disable or manual on/off commands (Building Manager). A second (higher-level) shall be used for actual change of the life safety program (installer). These passwords shall be five (5) digits at a minimum. Upon entry of an invalid password for the third time within a one minute time period an encrypted number shall be displayed. This number can be used as a reference for determining a forgotten password.
5. The system programming shall be "backed" up via an upload/download program, and stored on compatible removable media. A system back-up disk shall be completed and given in duplicate to the building owner and/or operator upon completion of the final inspection. The program that performs this function shall be "non-proprietary", in that, it shall be possible to forward it to the building owner/operator upon his or her request.
6. The installer's field programming and hardware shall be functionally tested on a computer against known parameters/norms which are established by the FACP manufacturer. A software program shall test Input-to-Output correlations, device Type ID associations, point associations, time equations, etc. This test shall be performed on an IBM-compatible PC with a verification software package. A report shall be generated of the test results and two copies turned in to the engineer(s) on record.

R. Specific System Operations

1. Smoke Detector Sensitivity Adjust: Means shall be provided for adjusting the sensitivity of any or all analog intelligent smoke detectors in the system from the system keypad or from the keyboard of the video terminal. Sensitivity range shall be within the allowed UL window.
2. Alarm Verification: Each of the Intelligent Addressable Smoke Detectors in the system may be independently selected and enabled to be an alarm verified detector. The alarm verification function shall be programmable from 5 to 50 seconds and each detector shall be able to be selected for verification during the field programming of the system or anytime after system turn-on. Alarm verification shall not require any additional hardware to be added to the control panel. The FACP shall keep a count of the number of times that each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.

S. System Point Operations:

1. Any addressable device in the system shall have the capability to be enabled or disabled through the system keypad or video terminal.
2. System output points shall be capable of being turned on or off from the system keypad or the video terminal.
3. Point Read: The system shall be able to display the following point status diagnostic functions without the need for peripheral equipment. Each point shall be annunciated for the parameters listed:
  - a. Device Status.

- b. Device Type.
  - c. Custom Device Label.
  - d. Software Zone Label.
  - e. Device Zone Assignments.
  - f. Analog Detector Sensitivity.
  - g. All Program Parameters.
4. System Status Reports: Upon command from an operator of the system, a status report will be generated and printed, listing all system statuses:
5. System History Recording and Reporting: The fire alarm control panel shall contain a history buffer that will be capable of storing up to 4000 system events. Each of these events will be stored, with time and date stamp, until an operator requests that the contents be either displayed or printed. The contents of the history buffer may be manually reviewed; one event at a time, and the actual number of activations may also be displayed and or printed. History events shall include all alarms, troubles, operator actions, and programming entries.
6. The history buffer shall use non-volatile memory. Systems which use volatile memory for history storage are not acceptable.
7. Automatic Detector Maintenance Alert: The fire alarm control panel shall automatically interrogate each intelligent system detector and shall analyze the detector responses over a period of time.
8. If any intelligent detector in the system responds with a reading that is below or above normal limits, then the system will enter the trouble mode, and the particular Intelligent Detector will be annunciated on the system display, and printed on the optional system printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.
9. The system shall include the ability (programmable) to indicate a "pre-alarm" condition. This will be used to alert maintenance personnel when a detector is at 80% of its alarm threshold in a 60 second period.

#### 2.4 SYSTEM COMPONENTS:

- A. Speakers. Speakers may be combined with strobes or stand alone. System Sensor SPW (wall) or SPCW (ceiling) in white.
  1. All speakers shall operate on 25 VRMS or with field selectable output taps from 0.25 to 2.0 Watts.
  2. Speakers in corridors, classrooms and public spaces shall produce a nominal sound output of 83 dBA at 10 feet (3m).
  3. Frequency response shall be a minimum of 400 HZ to 4000 HZ.
  4. The back of each speaker shall be sealed to protect the speaker cone from damage and dust.
- B. Strobes. System Sensor SW (wall) or SCR (ceiling) in white. Strobes may be combined with speakers or stand alone. Strobe lights shall be multi-candela units and meet the requirements of the ADA, UL Standard 1971, be fully synchronized, and shall meet the following criteria:
  1. The maximum pulse duration shall be 2/10 of one second.
  2. Strobe intensity shall meet the requirements of UL 1971.
  3. The flash rate shall meet the requirements of UL 1971.
- C. Portable Emergency Telephone Handset Jack. Notifier FPJ.
  1. Portable emergency telephone handset jacks shall be flush mounted on stainless steel plates as indicated on plans. Handset jacks shall be approved for emergency telephone system application.
  2. Insertion of a remote handset plug into a jack shall send a signal to the fire command center which shall audibly and visually indicate the on-line condition, and shall sound a ring indication in the handset.

3. The two-way emergency telephone system shall support a minimum of seven (7) handsets on line without degradation of the signal
- D. Firefighters Telephones. Notifier FHS.
1. Fire fighters telephone cabinet shall include storage space for six handsets. Provide storage cabinet and six handsets.
  2. Storage cabinet shall be Model FHSC-S. Provide six handsets.
- E. Synchronized Audible/Visual Signaling Device Power Supplies
1. Synchronized audible/visual device remote power supplies shall be UL listed for fire alarm signaling and provide 6 amps of 24 VDC power. The power supply shall include 2 class A or 4 class B synchronized notification appliance circuits. Provide two 7.0 amp hour batteries with each power supply.
  2. Remote power supply shall be model FCPS-24S6. Provide as required for signals.
- F. Digital Communicator Transmitter
1. Digital Communicator Transmission Equipment shall be UL listed and include a commercial fire digital communicator complete with the following features:
  2. Meet NFPA 72 requirements for Digital Alarm Communicator Transmitter.
  3. Meet NFPA 72 requirements for Digital Alarm Communicator Transmitter.
  4. Capable of seizing the telephone line at the protected premises, disconnecting an outgoing or incoming call, and preventing its use until signal transmission has been completed.
    - a. Contain a minimum of 4 channels.
    - b. Connected to two separate telephone lines at protected premises.
    - c. Capable of selecting the operable line in the event of a failure on either line.
    - d. Programmed to call a second number should the signal transmission be unsuccessful.
    - e. Equipped with battery pack, charger, telephone jack, and dedicated 120 VAC receptacle.
    - f. The contractor will provide cable, connectors and installation of two CO telephone lines and interface in accordance with FCC Part 68 using a USOC-#RJ31-X jack. The owner shall furnish two standard business lines for this purpose.
    - g. The digital communicator shall be connected to the fire alarm system to receive and transmit alarm signals, trouble conditions and supervisory conditions. Monitoring service shall be furnished by the owner. Notifier 411UDAC.
- G. Smoke Alarms
1. Smoke alarms in sleeping units shall be 120 volt smoke alarms and include 9 volt battery back-up. The detectors shall produce a code 3 temporal evacuation sounder and be connected to the FACP
- 2.5. SYSTEM COMPONENTS - ADDRESSABLE DEVICES
- A. Addressable Devices - General
1. Addressable devices shall provide an address-setting means using rotary decimal switches.
  2. Addressable devices shall use simple to install and maintain decade (numbered 0 to 9) type address switches. Devices which use a binary address or special tools for setting the device address, such as a dip switch are not an allowable substitute.

3. Detectors shall be Analog and Addressable, and shall connect to the fire alarm control panel's Signaling Line Circuits.
  4. Addressable smoke and thermal detectors shall provide dual (2) status LEDs. Both LEDs shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LEDs shall be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. If required, the flashing mode operation of the detector LEDs can be programmed off via the fire control panel program.
  5. The fire alarm control panel shall permit detector sensitivity adjustment through field programming of the system. Sensitivity can be automatically adjusted by the panel on a time-of-day basis.
  6. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 7.
  7. The detectors shall be ceiling-mount and shall include a separate twist-lock base which includes a tamper proof feature.
  8. The detectors shall provide a test means whereby they will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.
  9. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (example: ION, PHOTO, THERMAL).
- B. Addressable Manual Fire Alarm Box (manual station). Notifier NBG-12LX
1. Addressable manual fire alarm boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
  2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
  3. Manual fire alarm boxes shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1.75 inches (44 mm) or larger.
- F. Intelligent Multi Criteria Acclimating Detector. Notifier FATP-851
1. The intelligent multi criteria Acclimate detector shall be an addressable device that is designed to monitor a minimum of photoelectric and thermal technologies in a single sensing device. The design shall include the ability to adapt to its environment by utilizing a built-in microprocessor to determine it's environment and choose the appropriate sensing settings. The detector design shall allow a wide sensitivity window, no less than 1 to 4% per foot obscuration. This detector shall utilize advanced electronics that react to slow smoldering fires and thermal properties all within a single sensing device.
  2. The microprocessor design shall be capable of selecting the appropriate sensitivity levels based on the environment type it is in (office, manufacturing, kitchen etc.) and then have the ability to automatically change the setting as the environment changes (as walls are moved or as the occupancy changes).
  3. The intelligent multi criteria detection device shall include the ability to combine the signal of the thermal sensor with the signal of the photoelectric signal in an effort to react hastily in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a false alarm condition by examining the characteristics of the thermal and smoke sensing chambers and comparing them to a database of actual fire and deceptive phenomena.
- G. Intelligent Thermal Detectors. Notifier FST Series.
1. Thermal detectors shall be intelligent addressable devices rated at one of the following:
  2. 135 degrees Fahrenheit and a rate-of-rise element rated at 15 degrees F per minute

3. 135 degrees Fahrenheit fixed temperature.
  4. 190 degrees Fahrenheit fixed temperature.
- H. Intelligent Duct Smoke Detector. Notifier DNR with FSP-851 Detector Head.
1. The smoke detector housing shall accommodate an intelligent photoelectric detector that provides continuous analog monitoring and alarm verification from the panel. Provide sampling tubes of required length and in concealed spaces a remote LED indicator.
  2. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.
- J. Addressable Dry Contact Monitor Module. Notifier FMM-1 (single point) FDM-1 (dual point).
1. Addressable monitor modules shall be provided to connect one supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLCs.
  2. The IDC zone shall be suitable for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
  3. For difficult to reach areas, the monitor module shall be available in a miniature package and shall be no larger than 2-3/4 inch (70 mm) x 1-1/4 inch (31.7 mm) x 1/2 inch (12.7 mm). This version need not include Style D or an LED.
- L. Addressable Control Module. Notifier FCM-1.
1. Addressable control modules shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered, polarized audio/visual notification appliances.
  2. The control module NAC may be wired for Style Z or Style Y (Class A/B) with up to 1 amp of inductive A/V signal, or 2 amps of resistive A/V signal operation.
  3. Audio/visual power shall be provided by a separate supervised power circuit from the main fire alarm control panel or from a supervised UL listed remote power supply.
  4. The control module shall be suitable for pilot duty applications and rated for a minimum of 0.6 amps at 30 VDC.
- M. Addressable Relay Module. Notifier FRM-1.
1. Addressable Relay Modules shall be available for HVAC control and other building functions. The relay shall be form C and rated for a minimum of 2.0 Amps resistive or 1.0 Amps inductive. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to insure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.
- O. Smoke Control Annunciator. Notifier SCS series.
1. On/Auto/Off switches and status indicators (LEDS) shall be provided for monitoring and manual control of each fan, damper, HVAC control unit, stairwell pressurization fan, and smoke exhaust fan. To ensure compliance the units supplied shall meet the following UL categories : UUKL, PAZX, UDTZ, QVAX as well as the requirements of NFPA 92A & 92B, Smoke Control.
  2. The OFF LED shall be Yellow, the ON LED shall be green, the Trouble/Fault LED shall be Amber/Orange for each switch. The Trouble/Fault indicator shall indicate a trouble in the control and/or monitor points associated with that switch. In addition, each group of eight switches shall have two LEDS and one momentary switch which allow the following functions: An Amber LED to indicate an OFF-NORMAL switch position, in the ON or OFF position; A Green LED to indicate ALL AUTO switch position; A Local Acknowledge/Lamp Test momentary switch.
  3. Each switch shall have the capability to monitor and control two addressable inputs and two addressable outputs. In all modes, the ON and OFF indicators shall continuously follow the device

status not the switch position. Positive feedback shall be employed to verify correct operation of the device being controlled. Systems that indicate on/off/auto by physical switch position only are not acceptable.

4. All HVAC switches (i.e., limit switches, vane switches, etc.) shall be provided and installed by the HVAC contractor.
  5. It shall be possible to meet the requirements mentioned above utilizing wall mounted custom graphic.
- P. Serially Connected Control/Annunciator Requirements. Notifier ACM series.
1. The annunciator shall communicate to the fire alarm control panel via an EIA 485 (multi-drop) two-wire communications loop. The system shall support two 6,000 ft. EIA-485 wire runs. Up to 32 annunciators, each configured up to 96 points, may be connected to the connection, for a system capacity of 3,072 points of annunciation.
  2. An EIA-485 repeater shall be available to extend the EIA-485 wire distance in 3,000 ft. increments. An optional version shall allow the EIA-485 circuit to be transmitted over Fiber optics. The repeater shall be UL864 approved.
  3. Each annunciator shall provide up to 96 alarm and 97 trouble indications using a long-life programmable color LED's. Up to 96 control switches shall also be available for the control of Fire Alarm Control Panel functions. The annunciator will also have an "ON-LINE" LED, local piezo sounder, local acknowledge and lamp test switch, and custom zone/function identification labels.
  4. The annunciator may be field configured to operate as a "Fan Control Annunciator". When configured as "Fan Control," the annunciator may be used to manually control fan or damper operation and can be set to override automatic commands to all fans/dampers programmed to the annunciator.
  5. Annunciator switches may be programmed for System control such as, Global Acknowledge, Global Signal Silence, Global System Reset, and on/off control of any control point in the system.
  6. An optional module shall be available to utilize annunciator points to drive EIA-485 driven relays. This shall extend the system point capacity by 3,072 remote contacts.
  7. The LED annunciator shall offer an interface to a graphic style annunciator and provide each of the features listed above.
- Q. Serially Connected English Display LCD Annunciator. Notifier LCD-160 series.
1. The annunciator shall communicate to the fire alarm control panel via an EIA 485 (multi-drop) two-wire communications loop. The system shall support two 6,000 ft. EIA-485 wire runs. Up to 32 annunciators,
  1. Each annunciator shall provide a 640 character display and replicate the control of Fire Alarm Control Panel functions. The annunciator will also have an "ON-LINE" LED, local piezo sounder
- 2.6 BATTERIES AND EXTERNAL CHARGER:
- A. Battery:
1. Shall be 12 volt, Gell-Cell type.
  2. Battery shall have sufficient capacity to power the fire alarm system for not less than twenty-four hours plus 5 minutes of alarm upon a normal AC power failure.
  3. The batteries are to be completely maintenance free. No liquids are required. Fluid level checks refilling, spills and leakage shall not be required.
- B. External Battery Charger:
1. Shall be completely automatic, with constant potential charger maintaining the battery fully charged under all service conditions. Charger shall operate from a 120/240-volt 50/60 hertz source.
  2. Shall be rated for fully charging a completely discharged battery within 48 hours while simultaneously supplying any loads connected to the battery.



3. Shall have protection to prevent discharge through the charger.
4. Shall have protection for overloads and short circuits on both AC and DC sides.

### PART 3.0 - EXECUTION

#### 3.1. INSTALLATION:

- A. Installation shall be in accordance with the NEC, NFPA 72, local and state codes, as shown on the drawings, and as recommended by the major equipment manufacturer.
- B. All conduit, junction boxes, conduit supports and hangers shall be concealed in finished areas and may be exposed in unfinished areas. Smoke detectors shall not be installed prior to the system programming and test period. If construction is ongoing during this period, measures shall be taken to protect smoke detectors from contamination and physical damage.
- C. All fire detection and alarm system devices, control panels and remote annunciators shall be flush mounted when located in finished areas and may be surface mounted when located in unfinished areas.
- D. Manual Pull Stations shall be suitable for surface mounting or semiflush mounting and shall be installed not less than 42 inches, nor more than 48 inches above the finished floor.

#### 3.4. TYPICAL OPERATION:

- A. Actuation of any manual station, smoke detector heat detector or water flow switch shall cause the following operations to occur unless otherwise specified:
  1. Activate all programmed speaker circuits.
  2. Actuate all strobe units until the panel is reset.
  3. Light the associated indicators corresponding to active speaker circuits.
  4. Release all magnetic door holders to doors to adjacent zones on the floor from that the alarm was initiated.
  5. Return all elevators to the primary or alternate floor of egress.
  6. A smoke detector in any elevator lobby shall, in addition to the above functions, return all elevators to the primary or alternate floor of egress.
  7. Smoke detectors in the elevator machine room or top of hoistway shall return all elevators in to the primary or alternate floor. Smoke detectors or heat detectors installed to shut down elevator power shall do so in accordance with ANSI A17.1 requirements and be coordinated with the electrical contractor.
  8. Duct type smoke detectors shall, in addition to the above functions shut down the ventilation system or close associated control dampers as appropriate.
  9. Activation of any sprinkler system low pressure switch or valve tamper switch shall cause a system supervisory alarm indication.

#### 3.5. TEST:

- A. Provide the service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system.
- B. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
- C. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.
- D. Verify activation of all flow switches.

- E. Open initiating device circuits and verify that the trouble signal actuates.
- F. Open signaling line circuits and verify that the trouble signal actuates.
- G. Open and short notification appliance circuits and verify that trouble signal actuates.
- H. Ground initiating device circuits and verify response of trouble signals.
- I. Ground signaling line circuits and verify response of trouble signals.
- J. Ground notification appliance circuits and verify response of trouble signals.
- K. Check presence and audibility of tone at all alarm notification devices.
- L. Check installation, supervision, and operation of all intelligent smoke detectors during a walk test.
- M. Each of the alarm conditions that the system is required to detect should be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control points.
- N. When the system is equipped with optional features, the manufacturer's manual should be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

3.6 FINAL INSPECTION:

- A. At the final inspection a factory trained representative of the manufacturer of the major equipment shall demonstrate that the systems function properly in every respect.

3.7 INSTRUCTION:

- A. Provide instruction as required for operating the system. Hands-on demonstrations of the operation of all system components and the entire system including program changes and functions shall be provided.
- B. The contractor and/or the systems manufacturer's representatives shall provide a typewritten "Sequence of Operation."

**END OF SECTION**